More than 25,000 Copies per Week

Electrical World

McGraw-Hill Company, Inc. New York, February 5, 1921 Twenty-five Cents a Copy

The United States Chamber of Commerce survey indicates a shortage of 1,250,000 homes in the United States. To make up this deficiency homes will be built, and the electrical part of this construction program will cost around a half billion dollars for material and labor.

The Bryant Line, made by the largest manufacturer in the world of electrical wiring devices, offers the complete source of supply for switches, sockets, receptacles, attachment plugs—in fact, adevice to meet every electrical need.

Ask for our new catalogue.

BRYANT

SUPERIOR WIRING DEVICES

THE BRYANT ELECTRIC COMPANY

BRIDGEPORT, CONN.

NEW YORK CHICAGO SAN FRANCISCO

Unvarying Efficiency

Weston
Model 1

Portable Direct Current Instruments

are permanent magnet, movable coil instruments which are particularly adapted for the precise measurement of current and voltage.

Their accuracy is within ¼ of 1 per cent of full scale value under all practical working conditions.

They are provided with legible scales having mirrors over which the knife-edge pointers travel, thus facilitating reading.

These instruments are regularly furnished as Ammeters, Voltmeters, Milliammeters, Millivoltmeters and Micro-ammeters.

Bulletin 501 sent upon request. Write for it.

Weston Electrical Instrument Company
13 Weston Ave., Newark, N. J.

Branches in the Principal Cities throughout the World

New York
Chicago
Philadelphia
Boston
Cleveland
Detroit
St. Louis
San Francisco
Denver
Cincinnati
Pittsburgh
Richmond

Model 1 Portable
Direct Current Ammeter

Buffalo
Minneapolis
New Orleans
Jacksonville
Seattle
Toronto
Montreal
Halifax
Winnipeg
Vancouver
Calgary, Alta.

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician
Published by McGraw-Hill Company, Inc.

W. H. ONKEN, Jr., Editor D. H. BRAYMER, Managing Editor

S. B. WILLIAMS, Assistant Managing Editor A. M. PERRY, Engineering Editor J. C. MARTIN, Western Editor G. E. ARMSTRONG, Pacific Coast Editor H. S. KNOWLTON, New England Editor

Associate Editors: P. S. BIEGLER, C. T. BALDWIN, S. N. CLARKSON, R. H. BACON, T. P. KINDIG, R. M. DAVIS, E. H. HUBERT, F. C. WELLS

Volume 77 New York, Saturday, February 5, 1921 *Number 6*

Stepping Stones to Good Will

FORTUNATELY there are no secrets in the electric light and power business. The element of competition being absent, every manager, engineer and commercial agent is free to divulge to his fellows in the business just how he has floated a successful loan, improved the station efficiency or increased the sale of energy or appliances. This is real co-operation, valuable alike to the company and its patrons, both of whom gain through this free and frank interchange of information. Thus a spirit of good will is fostered between leading central-station men and organizations all over the country. Excellent as it is, however, it is not enough. The intimacy must embrace in a way the general public, but with so much privacy and so many inner offices separating the executives of the company from its patrons how is this possible? If proper public relations are to be maintained, the barrier must be removed and every manager of a public utility made "get-at-able." In fact, the whole business should be conducted, as it were, in glass houses so that every one can see all that there is to be seen about its operation. That is the best basis for inspiring confidence and for establishing good will. It has the advantage of simplicity and is, moreover, effective.

Middle West Transmission Growing

AN INDICATION of the growth of power transmission in the Middle West is the recent operation for several weeks of interurban cars between Rockford, Ill., and Janesville, Wis., by energy transmitted 135 miles from the Prairie du Sac plant of the Wisconsin River Power Company. While operation in this way is not new even under Middle Western conditions, there are comparatively few Middle Western systems on which such a length of transmission can be found. While the West Coast and Southeastern sections of the country hold the record for interconnected systems and long-distance transmission, Middle Western progress is such that the general development in that section of long-distance transmission and large interconnected systems that will approach in size the developments of the other two sections seems to be a matter of a few years only.

The Colorado River Project

THE proposed development by the Southern California Edison Company of more than two and one-half million horsepower of hydro-electricity on the Colorado River is a plan to stagger the imagination. Immense as it is, however, the project cannot be viewed as an idle dream. Its realization will ultimately be forced by the necessity for new sources of energy to supplement the large developments now under way in the High Sierras on the San Joaquin River and its tributaries. These latter developments will eventually produce approximately 650,000 kw., and it is estimated that this entire output will be consumed within fifteen years. It is worthy of note also that the Colorado River project is proposed at a time when other utilities in many sections of the country find that their load is not increasing at a very rapid rate. In central and southern California, however, the utilization of electrical energy continues by leaps and bounds, and in reaching out for other sources of supply long before they are required the Southern California Edison Company is following its usual far-sighted policy.

A Crutch for the Pessimist

TO THOSE who have allowed themselves to become depressed by the business conditions of the past few months our monthly report on central-station operating statistics should come as a tonic. While industrial-plant energy requirements varied from 10 to 66 per cent below normal during November, the increased lighting and heating load was sufficient to carry the average daily output beyond any previous high mark. The revenue for November was also 3.1 per cent greater than ever before. Compared with a similar period during 1919, the kilowatt-hour output for November, 1920, showed an increase of 11.5 per cent. Of those central-station companies in the class that generate more than 100,000,000 kw.-hr. per year, no more than ten have reported a lower total output for 1920 than for 1919. It is apparent that electric central stations are not experiencing the depression so prevalent in other lines of industry.

The Status of the Electric Vehicle

NOTWITHSTANDING their many and great advantages, numerous electrical devices fail to awaken the imagination of the average man. Our large steam turbo-generator sets, inclosed as they are, give but little indication of their power, and the electric locomotive, lacking the noise and the attractive reciprocating motion of its steam competitor, disappoints the eye and deceives the mind. Approaching within 1 or 2 per cent of actual perfection, the electrical transformer is nevertheless the most unobtrusive thing imaginable to the layman, and even the sturdy motor, diminutive beside the machine it drives or the engine it displaces, is rarely accepted at its face value. People invariably associate power with bulk and noise, and it is because of this that the electric vehicle does not get its just due when compared with the gasoline-driven

machine. The electric car is too prosaic and quiet. If it could snort and chug outlandishly and if it were of hideous aspect, it might give a truer impression of its prowess. As it is, proof of its possibilities must be made, and even then the prospective buyer accepts it with reservations. To the electrical man this phase of human psychology is baffling. Nevertheless, it exists and allowance must be made for it. That the electric vehicle for city traffic is superior in the long run to its competitors is demonstrable, and there are still tremendous opportunities to conserve time, labor and money and to promote efficiency in the handling of materials through its agency. The greatest problem concerns the marketing of the product, and its proper solution involves many complex and perplexing questions.

Each manufacturer may have very definite and pronounced views in regard to the ways and means to be employed, but unless the various ideas are thoroughly co-ordinated and a comprehensive plan agreed on a complete and satisfactory solution cannot be attained. One thing is certain, the problem is not technical, but is primarily and essentially a business one. If attacked in a spirit of tolerance, forbearance and helpfulness, rapid progress will be made. It is encouraging to note that the number of electrically propelled vehicles is increasing year by year, and the rapidity with which industrial trucks are establishing themselves in warehouses and factories is surprising. Eventually the electric vehicle will fill its proper place in the transportation world. Of that there can be no doubt. Its inherent advantages cannot be forever obscured by the glamor surrounding the gasoline machine. Meanwhile if the electrical industry will accept it as it is and apply it, needed encouragement will be given. Confidence is the basis and measure of development, not idealistic conceptions of the millennium.

Improvement of Industrial Illumination

AS A RULE the advent of improved material is the result of demand for more effective application in obtaining results. Oddly enough, industrial illumination furnishes an instance to the contrary, for electric lamps and their equipment are awaiting proper utilization. When it is considered that the last decade has brought down the cost of light as a raw material to one-tenth its initial value it seems strange indeed that its liberal and skillful use should have fallen behind. Progress is under way, to be sure, but it is slow, and innumerable manufacturing establishments, to their own serious loss, are still working with illumination fully ten years behind. There is no excuse for poor lighting on the ground of expense, for if, using his own cost per kilowatt-hour, one figures out the expense of energy per foot-candle-hour per acre, let us say, the false economy of current practice becomes self-evident.

One of the most striking recent investigations on the subject bears directly on the relation of output to illumination, and the results plainly show that better lighting implies not only better work, with the ability to see easily, but more work, owing to the fact that poor lighting slows down efficient vision. The workman with plenty of light well distributed and free from glare can work, and instinctively does work, at a better pace than the man who is struggling along with just light enough to perform his task after a fashion. How far increase in illumination can be carried with advantage from the standpoint of quantity and quality of output has not yet been determined, although it is certain that the limit lies far beyond ordinary practice. If industrial illumination should actually keep up with its opportunities, we should anticipate an increase in the use of light even more rapid than the increase in motor service.

Water Power as an Asset in Austria's Regeneration

FEW Americans actually realize the changes the war has wrought in the old Austro-Hungarian Empire, and fewer still will lack some measure of active sympathy in the troubles of the Austrian Republic, which is the sole territorial remnant of the widespread domain of the luckless Hapsburgs. A striking article from the editors of the chief electrotechnical journal of Austria in this issue gives a vivid idea of what has happened. After the partition of the empire had cut off Czechoslovakia, Poland and Jugoslavia and assigned territory to Rumania and Italy the Austrian Republic was cut down into an area less than that of the State of Maine with a population of six and a half millions. Thus reduced to about one-eighth of the imperial territory, the republic is doubly unfortunate in lack of raw material, especially coal and iron. Most of the material used in the electrical manufactures for which Austria has been famous was obtained from what is now Poland or Czechoslovakia. As a result the electrical, and indeed all, manufactures have suffered, and industry is singularly slow in recovery. The number of workmen is cut in two, and although the wages per man have doubled in the last two years, they have not kept pace with the cost of necessities, so that a large proportion of the working people are undernourished and in poor physical condition. Credit is stopped, and the only terms on which manufacture can be undertaken are cash on placing the order. Prices are therefore uncertain, for the fluctuation is continuous and cannot be predicted.

With all this in the way of discouragement, it is gratifying to note that the manufacturers of the Austrian Republic are exerting every effort to get once more upon a sound basis. They are preparing for work when more normal times are reached, and the electrical industry is perhaps more hopeful than the most. There are large resources in water power as yet undeveloped, and with the totally insufficient supply of coal and crude oil the development of these powers and the supply of transmitted energy is a certainty. The electrification of the railroads is one of the important steps under contemplation to free the republic from dependence on imported fuel. Austrian electric lamps, one of the most important features of export in the past, are still making their way into foreign countries, and with the excellent reputation which they have always had they are likely to continue as an important article of manufacture.

The Electrotechnical Society of Vienna, which has played a valuable part in the upbuilding of industry, is turning its energies to getting back something of the old trade. It is to the possibilities in developing power, however, that attention should chiefly be directed in the effort to regain for the republic something of the industrial capacity which the loss of the main coal supply has so seriously diminished.

Industrial Heating to Improve Power Factor and Load Factor

TWO big problems before the central-station industry are those of improvement of power factor and of increase of load factor. Industrial heating promises to assist materially in both endeavors. Whereas it will take time to get results by discouraging low-power-factor loads, it is possible to improve immediately the system conditions as a whole by adding large blocks of high-power-factor industrial heating load. In most instances industrial heating promises a continuous process; therefore, though it will increase the peak, it will also increase the load at the low-load period and the net gain will be high load factor. Filling the low places in the load curve presents great difficulties that it will take many years to overcome, but it is possible to obtain some improvements now by the connection of industrial heating loads. Besides its other benefits, industrial heating offers an excellent source of revenue. The progressive central-station companies can be expected to take full advantage of these opportunities.

It Is Time to Be More Specific

WE HAVE already noted the report of the National Board of Fire Underwriters and the rejoinder of the Society for Electrical Development regarding fires from electrical causes. The facts presented by the underwriters are less important than the somewhat sensational way in which they were put. It is one thing to headline electricity as the chief source of fires and quite another to report that it was the source of about 6 per cent of the total fire damage of the last five years. The rejoinder of the Society for Electrical Development showed that of all fires investigated and reported to it about 2½ per cent were of electrical origin. The statistics put forward by the Board of Fire Underwriters deserve more than casual study, and the time is ripe for a complete exposition of the relations derivable from the data. If even 6 per cent of the fire damage in the country is due to electrical causes, it is of high importance, considering the aggregate amount of damage done, to know just how and why electrical causes were responsible. Incidentally it would be interesting to know the nature of the correlation between fires reputed to be electrical and those charged to other causes. For instance, what was the proportion of fires charged to spontaneous combustion and our old friends rats and matches in wired and unwired buildings respectively? In what proportion of the reputed causes of electrical fires was the actual nature of the electrical failure responsible for the fire determined? Of such instances what were chargeable to modern installations made under the rules of fire underwriters and what to installations of an earlier date made without suitable inspection? In other words, there is direct need for finding out, in so far as can be ascertained from statistics, what is the exact character of the risks fairly attributable to electrical causes and what is the relation of these causes to the actual circumstances of electrical distribution.

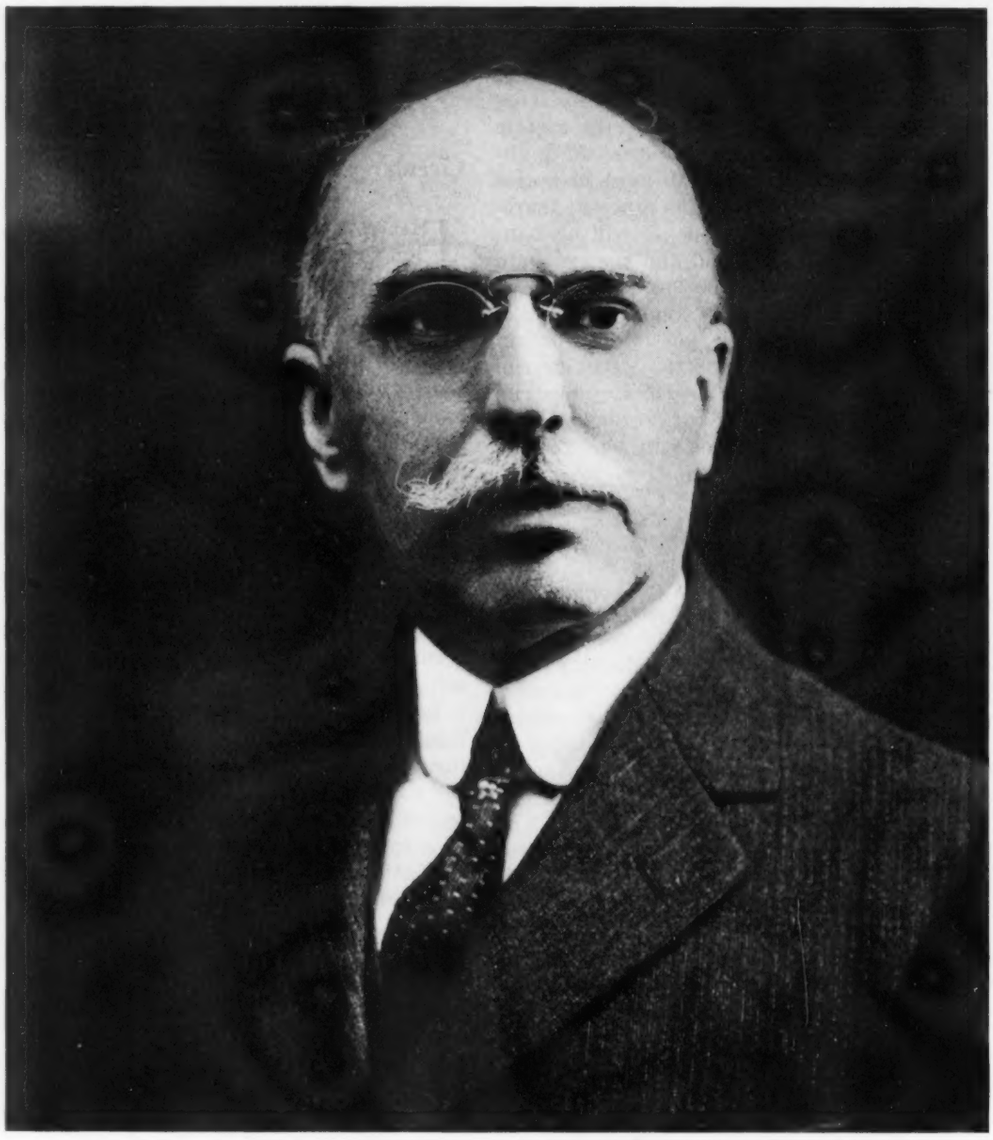
Our memory runs back over a good many years to the time when a wire in the next street was sufficient whenever an alarm was sounded to cause an outcry against the fire risks due to electricity. That day has happily gone by, but pointing to electricity as the chief classified cause of the huge fire loss of the country, even when the actual percentage of loss is small, is an accusation which demands prompt attention. The Society for Electrical Development is to be commended for its work in investigating the statistics of the fire underwriters and running down with punctilious care the various correlations disclosed.

Circular Versus Rectangular Coils for 220-Kv. Transformers

THE advance to 220 kv. for power transmission, long foreshadowed, is apparently definitely realized in the construction of four 8,333-kva. transformers for the Southern California Edison Company. These transformers, while having for their immediate purpose the relief of the overloaded 165-kv. lines of the Southern California Power Company, will eventually form a permanent link in the proposed 220-kv. California power bus. The Pacific Coast therefore will probably be the first to produce a superpower transmission system.

The construction of the transformers mentioned is described in a paper by Clinton Jones in this issue. Aside from the interest attaching to the figure of the high-tension voltage, noteworthy features are the circular type of coil with its bracing against short circuits, the oil conservator, whereby the main case of the transformer is completely filled with oil, thus eliminating air, and the 220-kv. terminal bushing. Particular stress is laid upon the advantages of the circular coil over the familiar rectangular-shaped coil of the shell-type transformer. The advantages claimed are superior mechanical characteristics as against the stress from concentrated leakage flux under short circuit, the practicability of assembling with frequent cross-bracing in the direction of oil flow, the protection of turn insulation from mechanical injury, and increased reliability in the major insulation between the primary and the secondary. It is further claimed that there is increased cooling efficiency of the oil ducts.

The original reasons for the adoption of the rectangular-shaped coils were probably the reduction of the voltage between layers and the intermingling in assembly of primary and secondary coils, reducing the leakage flux and internal reactance. With increasing sizes and vertical types the advantage of longitudinal conduction of heat to the upper exposed ends of the coils is also recognized. Considering these things from the standpoint of the circular coil, it is possible to reduce the voltage between layers to the same extent, although generally a greater number of coils will be necessary. In the matter of leakage reactance it is probable that neither type has the advantage, particularly as reactance has lost most of its early terrors and, in fact, in many instances is desirable nowadays. Neither in the matter of efficiency of oil cooling is a superior position certain for either type; the considerations set forth in the article referred to show some advantages for the circular coil, although it is not apparent that these offset the salient feature of the vertical rectangular coil, of straight conduction to the exposed ends and the direction of this conduction being paralleled by the upward flow of oil. It does not appear that the advantages claimed for either type are sufficiently definite to eliminate the other, and it is probable that transformers of both types and of about the same degree of reliability will continue to appear.



William Slocum Barstow

A pioneer and recognized leader in electric light and power utility management who by insisting on a proper balance between physical and financial operation has been able to rescue many properties that were apparently in a hopeless state

SOUND financing methods and ideals in management have always been of paramount interest to electric light and power utilities, but at no time have they been more absorbing than today. Bankers and managers are beginning to call for some permanent financial plan sufficiently flexible to accommodate itself easily to current rates for money and investment demand. One who has advocated this principle for years and who is recognized as an authority on public utility finance and a rebuilder of electric light and power properties that through mismanagement and poor financing have been allowed to run down is W. S. Barstow, electrical engineer, operator, manager, financier and president of the General Gas & Electric Company, with properties in Pennsylvania, Ohio, New Jersey, New York and Vermont. Included in these properties are those once controlled by the Atlantic Gas & Electric Company, a holding company which went on the financial rocks a few years ago.

Mr. Barstow's connection with the industry dates back to the old Edison Machine Works at Schenectady, where he started work in 1887. He had charge of construction of new plants for that organization. Upon completing the installation of the Brooklyn Edison system in 1889 he remained as electrical engineer and general superintendent and later became general manager. In 1901 he resigned to engage in the practice of consulting electrical engineering, and in 1906 he organized the engineering and management corporation of W. S. Barstow & Company. During the time he was with the Brooklyn Edison Company he acted in an advisory capacity for other electric light and power companies and as such effected the consolidation of the Edison companies in Cleveland. Under his management the Brooklyn Edison Company was one of the first to install multiphase transmission and substation distribution, low-tension arc lamps, storage batteries, the "booster" system and other devices then new.

As the result of this operating and management experience Mr. Barstow has come to believe that the electric light and power utility must be operated from both the physical and the financial viewpoint. While these points of view are apparently entirely different, they must be kept parallel or the company will come to grief. He has, accordingly, always advocated the maintenance of a well-defined balance between these two phases of utility operation. A week from next Tuesday Mr. Barstow will celebrate his fifty-fifth birthday. Mr. Barstow was born in Brooklyn, where he spent so much of his commercial life. In 1887 he was graduated from Columbia College. He is a fellow and life member of the A. I. E. E., of which he has been a vice-president. In numerous other electrical societies he has had an active part.

Elsewhere in this issue will be found a contribution from Mr. Barstow to the current discussion on financial structures. In this paper common stock is held to be fundamental.

Building First 220,000-Volt Transformers

Four 8,333-Kva., Single-Phase Units Are Being Manufactured for the Southern California Edison Company—Advantages of Circular Coils Are Set Forth—Standard Bushings for 220 Kv.

By CLINTON JONES
Transformer Department, General Electric Company, Pittsfield, Mass.

POPULAR interest in the so-called "super-power" system has been intensified by the coal and oil situation, by war conditions, the recently crippled condition of our transportation facilities and the probability of further railway electrification. Fortunately, electrical interests have long foreseen the ultimate necessity of higher voltage and larger power transmission systems—such transmission systems as would not only decrease the present waste in undeveloped power but also steadily increase the efficiency of all power in use and relieve the railroads of a vast amount of their present coal-carrying burden.

The movement toward this very vital national economy is being furthered by the enterprise and foresight of individual operators who are so planning and building their systems as greatly to simplify the eventual linking up of what may be termed the "key transmissions" of the various industrial and agricultural areas. The line voltage of 220,000, which has been tacitly agreed upon as being the approximate economic potential for these extensions and interconnections, constitutes a very abrupt step in the curve of maximum transformer voltages, as indicated in Fig. 1. Nevertheless, there is every indication that the use of 220,000 volts will be attended with just as much success as that which characterized the first operation of 150,000-volt apparatus by the Southern California Edison Company. The circular coil concentric winding design is being used for the first transformers and this construction has already proved of great value in the development toward a safer apparatus for very large powers and high voltages. The elimination of the air space in the main containing tank is another noteworthy advance, also the completion and standardization of an oil-filled 220,000-volt bushing to be interchangeable for all apparatus and services with the exception of the line itself.

The last step in potential—namely, to 220,000 volts—had been discussed for some time prior to 1920, but no actual moves were made by the operators until last summer, when the Southern California Edison Company placed an order with the General Electric Company for four water-cooled 50-cycle, 8,333-kva. transformers, arranged for operation at 220,000 volts, stepping from a generated voltage of 11,000. These will be used in the company's new hydro-electric station, to be known as "Big Creek No. 8," which will be a part of an ultimate development for the transmission of 750,000 hp. at 220,000 volts, over a distance of 240 miles (385 km.). One of these units is shown in the illustration. No definite time has yet been set for operation at 220,000 volts, but it must be in the near future, as the present lines of the Southern California Company will soon be loaded to their full capacity and it is imperative that more power be delivered to Los Angeles County at an early date. This transmission is interesting in that it will be available as a permanent link in the 220,000-volt California bus* by which it is proposed to interconnect all the large natural powers throughout the state.

There is now no doubt as to the commercial practicability of transmission potentials in the order of 200,000 volts. In fact, as far as transformers are concerned, it may be said that the transition from 150 to 220 kva. involves far less uncertainty than did the transition from 66 to 100 kva. The recent natural tendency toward the use of the grounded system, with its attendant stabilization of line potential, has been of great importance in this extension of voltage.

The turning point in coil construction in high-voltage transformer design came after the first experience in potentials of from 70 kv. to 100 kv. In order to understand better the needs of the situation, the General Electric Company early in 1910 began extensive investigation of all problems encountered in the operation of several of the early 100-kv. systems. These investigations included the systems of the Colorado Power and Great Western Power companies and were very complete and made at great expense. Furthermore, extensive laboratory apparatus was built for experimental purposes, making possible the duplication of phenomena existing in field service and thus permitting more careful and extended investigations. The results obtained were, as is quite usual in such cases, explained without much difficulty by theoretical and practical considerations, and it can be said in all confidence that all of the phenomena inimical to the safety and operation of high-voltage lines and apparatus are quite well known.

ADVANTAGES OF CIRCULAR COIL FOR HIGH-VOLTAGE TRANSFORMERS

Much has been said in regard to the merits of different typical transformer constructions for high-voltage work, so that it will not be amiss to examine the design of this pioneer 220,000-volt unit. It should be said here that the General Electric Company early committed itself to the use of the circular coil in small form-wound sections for all power transformers. The accumulated experience of the company, both in the early stages of the development of large power units, when the "shell" form with rectangular coils was used almost universally, and in these later years that have seen such remarkable strides in capacity and voltage, all points unmistakably to the circular coil as the keynote to permanent practice, and every danger that still threatens from the use of longer lines with higher voltage and larger powers is closely associated with some important characteristic of design dependent directly upon the form of the coil.

The superior mechanical characteristics of the small circular coil have already proved invaluable in constructing power units which will withstand the destruc-

*Paper by Sorensen, Cox and Armstrong, *A. I. E. E.*, 1919.

tive efforts of short circuit as demonstrated by actual tests with large powers at the company's Schenectady factory. These mechanical characteristics may be summed up in their larger sense as resulting:

First—From the fact that a transformer coil under magnetic stress from concentrated leakage flux—*i.e.*, under short circuit—tends to assume a circular form.

Second—From the practicability of assembling such coils with frequent cross-bracing in the direction of the oil flow, thus giving positive support to all conductors at short intervals without interfering with the cooling action of the coil.

The important advance in thermal characteristics made possible by this construction may also be summarized under two general heads—namely, the reduction in heat-blanketing effect of the intercoil bracing structure and the increased cooling efficiency of the oil ducts.

The first advantage accrues from the use of narrow coil and group-spacing braces at right angles to the conductors, thus reducing to a fraction of an inch the length of the heat-conducting path from center of brace to the oil. The second is the result of the very short oil duct in the circular coil assembly, where the oil flow is across instead of along the conductor and the length of

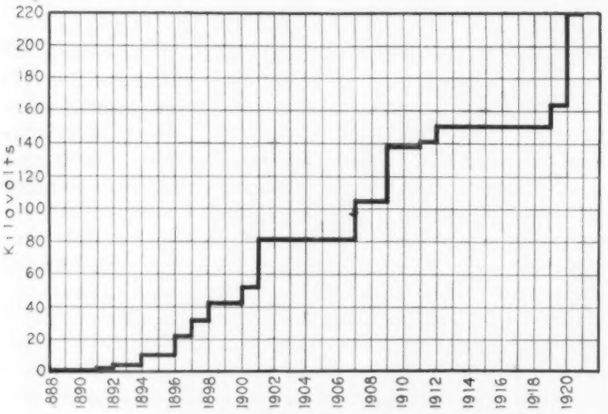


FIG. 1—INCREASE IN MAXIMUM POTENTIAL IN POWER TRANSFORMERS BY YEARS

the duct is determined by the width of the coil rather than its length. These combined advantages have made it possible to construct large power units in which the "hot-spot" temperature is mainly due to the difference in oil temperature as between the top and bottom coil levels, and this, in turn, can be controlled to a large extent in the design of the particular transformer and its cooling system.

PROTECTION OF COIL INSULATION FROM INJURY

The protection of turn insulation from mechanical injury both in manufacture and operation is also a noteworthy improvement characteristic of the small circular coil. As this is a very vital detail of any design, it will bear brief examination. Such insulation naturally occupies a very restricted space and must stand a high puncture voltage per mil. Uniformity is obviously necessary, and a plurality of thin layers is therefore advisable. To protect this fibrous insulation in the winding and treating process and to preserve it in operation has been made much more certain by the use of the small circular coil, which is wound with uniform tension, has no sharp corners and expands and contracts uniformly over the necessary wide range of operating temperatures.

It would be impracticable and out of place here to go into any great detail as to the merits of the circular coil construction and its adaptability within the commercial range of power transformers. Enough has been said, however, to indicate the basic reasons for the emphasis that the manufacturer has placed on the form of the coil. As the importance of insulation increases the importance of protecting it from mechanical damage or overheating also increases. Thus the natural ruggedness and uniform thermal qualities of the circular coil come into play with increased force. If the oil duct of a low-voltage transformer becomes partially clogged by oil deposit or the distortion of a coil due to magnetic stress, the only immediate effect may be an increase in local heating. If one of these things happens in an extra-high-voltage unit, it may easily cause a breakdown between coils at the next line disturbance.

Again, the circular-coil design admits of the concentric arrangement of windings as between high-voltage and low-voltage components. The General Electric Company has made this a requisite in high-voltage designs. In such construction the windings are more surely braced where there must be considerable striking distance between active parts and ground, since the principal magnetic forces are exerted radially between the windings, rather than vertically as in the "interleaved" designs where the resultant force must be taken by the core-clamp structure through insulating supports. The form of assembly also allows of a simplification and increased reliability in the major insulation. This consists of a number of concentric cylinders so installed between the windings with longitudinal spacers as to preclude any movement and closing of oil ducts.

The particular transformer under discussion is of the "core" type with two groups of windings on separate core legs for each phase. As far as the general arrangement of core and coils is concerned, it is similar to the Great Western Power unit shown in Fig. 2. It was designed for operation with neutral point permanently grounded, and this again lends additional interest to the concentric form on account of its exceptional adaptability to grounding.

The line end of the high-voltage winding is brought out through a new standard oil-filled 250,000-volt bushing which is interchangeable as between the transformers and high-tension oil circuit breakers. It will be interchangeable with any other bushings for 220,000-volt apparatus which may be furnished later. The external shell of this bushing consists of two porcelain pieces above the transformer cover, one porcelain piece below the cover and an intermediate metal cylinder which is flanged at the upper end to support the bushing. This metal portion always extends below the transformer oil level to avoid any possibility of corona in transformers having an air space between the oil level and cover. A metal tube extends from top to bottom through the center of the bushing, and the intervening space between this tube and the porcelain shell is filled with transil oil and concentric cylindrical insulating barriers. The glass chamber at the top provides space for expansion of the oil and indicates its level. The joints between the shell sections are made with treated cork gaskets compressed locally by numerous bolts engaging metal clamping rings. The central tube serves as the conductor when used in a breaker and as a conduit for a cable conductor in a transformer.

The bushing has a dry flash-over voltage of 660,000. The lightning flash-over is estimated at more than twice the normal frequency figure and is equal for wet or dry conditions. In the event of any high impressed voltages the bushing will not puncture but will arc from the terminal to ground without damage. The general design of the bushing is such that an essentially uniform surface distribution of potential is obtained, thus preventing corona on the surfaces.

The containing tank is of the "oil conservator" type, having a separate chamber for oil expansion (see Fig. 2A). The principles involved in this construction are to some extent in all transformers open to the air and is easily accelerated to the danger point during emergency overloads. It preserves the transformer insulations to a remarkable extent, as shown by actual time tests at various operating temperatures. While final conclusions cannot be drawn at present, owing to the protracted nature of such investigation, it can be said that the rate of deterioration of the usual organic transformer insulations is greatly reduced by the use of a conservator. Obviously, this is a very important step in advance and can be used to great advantage in high-voltage work.

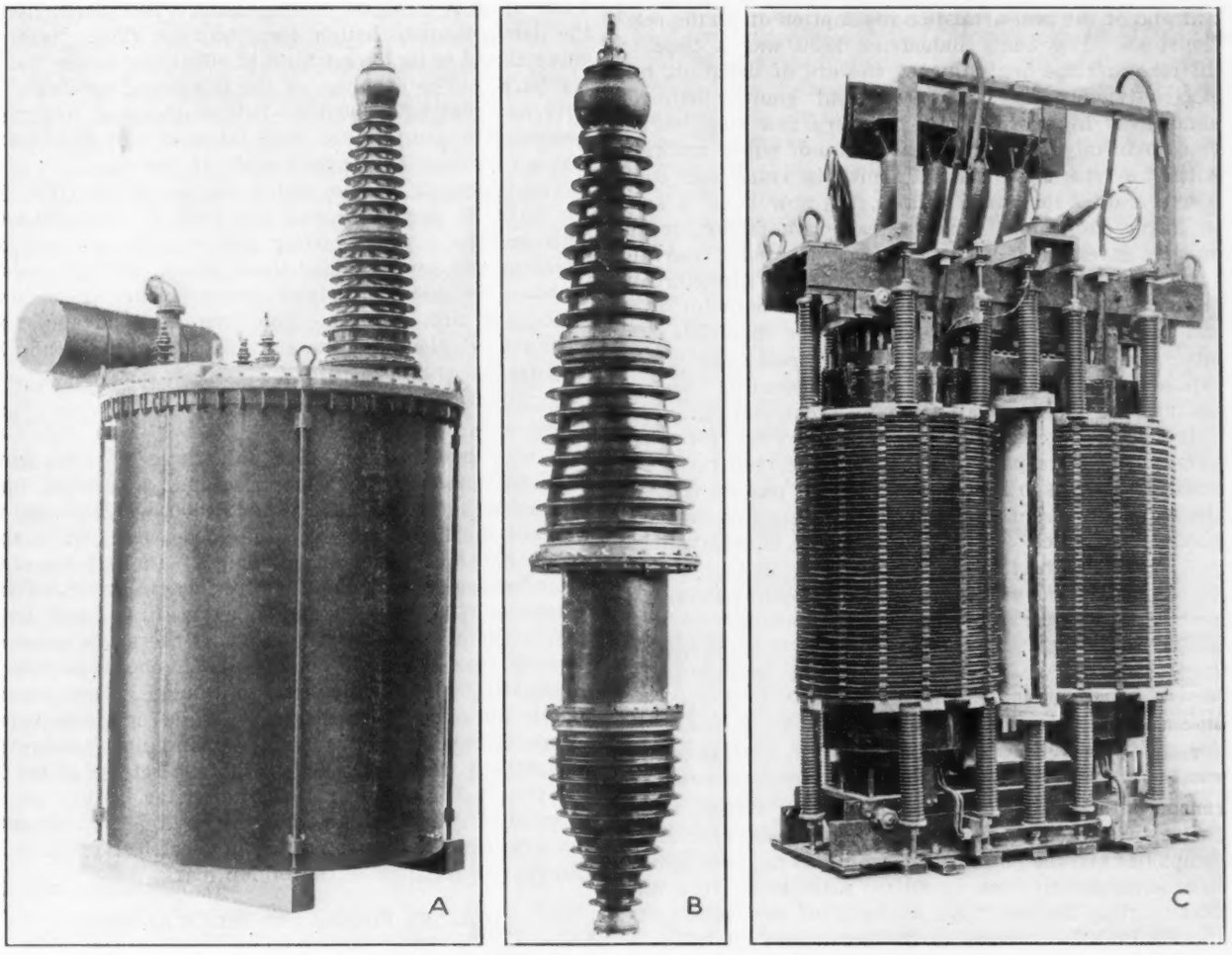


FIG. 2—WORLD'S FIRST 220,000-VOLT POWER TRANSFORMER

A—External view of the 220-kva., 8,333-kva. transformer, of conservator type. Four of these units are being built for the Southern California Edison Company and will be star connected in service.

B—This bushing, rated at 250 kv., maximum potential, will be used on 220-kv. lines for either transformers, oil circuit breakers or lightning arresters. It is said that the new 220-kv. transformer construction follows the general design of that shown in C, which is one of the 7,500-kva., 165-kv. transformers recently obtained by the Great Western Power Company.

the elimination of the usual air space above the oil in the main tank and the isolation of the hot oil and transformer insulation from the surrounding air. The main tank is always completely filled with oil, and pressure is prevented by opening the auxiliary tank to the outside air through a breathing device. Any accumulation of moisture in the auxiliary tank due to condensation is caught in a sump and may be drawn off through a pet cock at the bottom. This construction eliminates "breathing" in the main tank and keeps the oil absolutely dry. It avoids explosions due to a possible mixture of air and gas formed from hot or decomposed oil. It protects the oil from "sludging," which occurs

The total weight of this transformer is 50 tons, including oil. The height from rail to top of bushing is 24 ft. (7.3 m.), and the diameter is 10½ ft. (3.2 m.).

A current transformer is mounted on the cover and connected into the neutral circuit before the ground is made on the tank. The current transformers of three units (one three-phase bank) have their secondaries connected in parallel so that any unbalanced current (ground current) can be read.

It is an interesting fact that the manufacturer had actually designed this 220-kv. transformer long before any definite plans had been made by power interests for operation at this voltage.

Review of Electrical Business in 1920

Analysis of Conditions Gives Rise to Estimate of $4,200,000,000 Spent Last Year for Goods and Service—Prospects for Future Brighter Still

BY T. COMMERFORD MARTIN

THROUGHOUT the year just closed electrical development maintained to a degree even beyond reasonable expectation the rate of progress that had characterized it during the periods alike of the great war and of the post-armistice resumption of pacific relationships. For many industries 1920 was a time of distress and the beginning of the era of deflation, but electricity, broadly considered, had known little of abnormally high prices and has very few steps to retrace painfully. For the great group of public utilities, with the return to national sanity in trade and commerce and in industrial affairs, the new hope is seen in fairer quotations, fairer rates and a fairer income on the investment. The industry is really starting from the bottom upward, because others are starting from the top downward. The electrical note for 1921 can only be one of hopefulness. Raw materials and labor are in readjustment, with universal benefit, and capital itself, the world's savings, is becoming cheaper, because the savings are once more accumulating.

It has been the privilege of the writer for some twenty-five years past to submit to the readers of the ELECTRICAL WORLD a review of the year past as regards the expenditures of the American nation for electrical goods and service. Being based on the latest available census data, ELECTRICAL WORLD monthly statistics and the reports when obtainable of the great manufacturing companies and the public utilities in general, such figures have subsequently been found to "make good" in a very encouraging manner. An estimate of production and income in 1920 is made in the accompanying table.

ELECTRICAL PRODUCTION AND INCOME IN 1920

Central stations	$900,000,000
Electric traction	800,000,000
Telegraphy	250,000,000
Telephony	550,000,000
Electric manufacturing	1,250,000,000
Isolated plants	200,000,000
Miscellaneous	250,000,000
Total	$4,200,000,000

CENTRAL STATIONS

The figures of the United States Census Bureau for 1917 showed the central-station revenues of that year to be $526,886,408. Since that time the revenues of the industry have grown rapidly—roughly, as shown by the ELECTRICAL WORLD'S monthly statistics, 20 per cent annually. From these bases it was thought quite reasonable to estimate central-station earnings for 1920 at $900,000,000. The past year has seen central stations enjoying better rates in many instances. Some of the 1,250,000 new homes needed are already being built and occupied and industrials up to the late fall were using all the power available.

ELECTRIC TRACTION

Estimates of revenues of the street railways in 1919 from transportation are given by the American Electric Railway Association at $750,000,000. It is doubtful whether there has been very much advance over this figure in the intervening twelve months. It is true that fares have been raised, but it is also true that riding has decreased as a direct result. Morever, the "jitney" has taken from the electric railway a very handsome slice of its business. For these reasons it is not thought advisable to place the electric railway revenues from transportation at more than $800,000,000.

THE ARTS OF COMMUNICATION

It has been a hard job for the telegraph and telephone systems to recover from the injuries inflicted by a term of governmental management. But fortunately the damage done, though deep, was not vital. Service was reduced to its lowest form of efficiency, but is "coming back." The earnings of the telephone, set down in 1919 as about $475,000,000—Bell co-operative and "independent"—are now for 1920 taken at only $550,000,000, an increase of approximately 15 per cent.

The telegraph income, which was set at $200,000,000 for 1919, is now estimated for 1920 at $250,000,000. This includes a great variety and miscellaneousness of function and service—land lines, ocean cables, railway systems, "wireless," district systems, burglar alarms, police and fire systems. The "wireless" advances of 1919 are of splendid scope and magnitude, with infinite promise for the near future.

ELECTRICAL MANUFACTURING

It was shown that in 1918 only three of about nine hundred producers of supplies and apparatus had reached an audited total of $522,421,000, which of course was not the figure at which the goods were put in the hands of the customer and consumer. In 1919 the output of one electrical manufacturer was represented by orders of $237,000,000 and sales at first hand only $3,000,000 less. During the last year there was a ceaseless call for electrical goods. When one department of electrical manufacture lets up a bulge is seen immediately in some other direction, while demands heretofore unheard and unsuspected bring new producers into a field whose bounds will not be set by us or in our time. For the year 1920 the writer is very much tempted to rate the high-water mark at $1,250,000,000, the first time that any branch of electrical production and service has passed the billion mark.

ISOLATED PLANTS AND MISCELLANEOUS

It may be very much doubted whether there is any notable increase in the number of isolated plants in office buildings and factories. The great war has put an appreciable drag on that kind of development, as it has on the sinking of taxes in unprofitable municipal plants. But, per contra, there is a most interesting development in such isolated plants as the new battleships and the new lines of steamers, as well as in farm plants, for which the call is being met with feverish activity. The farmer has been educated by his "flivver" up to a desire for putting away his oil lamps with other back-number gear, and electricity has a strong growing appeal to him in 1920-21.

With an undeniable aggregate of more than four billions of electrical goods and service needed by our fellow-citizens in the year just ended, are we not called upon by the opportunities of 1921 to put forth energies not yet by any means fully extended in what has been done thus far? "The greater lies before."

Common Stock the Basis of Financing

The Physical and the Financial Structure of Utilities Are Equal Components, Although the Latter Has Not Been Receiving Equal Consideration from Regulating Bodies, with the Result that It Has Become Top-heavy Because of Too Much Borrowing and Too Little Investment

By W. S. BARSTOW
President W. S. Barstow & Company, New York

ALL corporate enterprises are made up of what might be termed two structures—physical and financial—and these function only when and as long as both are present. In an electric light and power company the physical structure is the power house and distributing system by means of which is generated, distributed and sold to the public the service of lighting and power. The financial structure is made up of the securities which are sold to the investor (stockholder) or lender (bond or note holder).

From these two sources—service and securities—money is obtained to operate, maintain and extend the property. As the physical structure makes use of public property which is necessarily confined as to its limits, the service rendered thereby is economically a monopoly, and to protect the public using the service regulations are made.

As the financial structure is made up of securities distributed over an unlimited territory throughout the world, its operations are competitive and automatically subject to regulation by the law of supply and demand. When, therefore, public service commissions attempt to regulate the financial structure which already has been regulated by the law of supply and demand, they may render it inoperative, in which case all money necessary to extend the physical structure must be derived from the returns for service. Under such a condition these returns would have to be so high that service could not be sold and expansion would be blocked.

Earnings Not Return on Investment

Regulating bodies have as yet only a general knowledge of the financial structure. On the other hand, their efficient engineering staffs have kept them fully informed on the physical property and its operation. One of the results has been the confused conception of earnings and return on investment. That these two are related to one another is of course unquestioned, but that relation should be clearly understood.

The state of the art today provides recognized means of fulfilling the requirements of the public for service, but no means are provided for fulfilling the requirements of the investor. The former relates to the proper operating, maintenance and extension of the property. The latter means the safeguarding of both the principal and the return on the investment. If the state and commission laws protect the public in the service but do not protect the investor, or vice versa, the enterprise fails.

The investor or stockholder in any enterprise should not be confused with the lender or bondholder, whom the enterprise must at some time pay back and who, when this is done, is no longer a factor in the financial structure. The investor's interest remains permanently in the property, although this interest may be passed from individual to individual. The majority of state laws and commission rulings make it difficult in many ways to interest the investor but easy to interest the lender. As a result, the financial structure of the public service enterprise has become top-heavy and in danger of falling owing to the heavy debts, which have gradually grown to a point where the foundation established by the investor becomes too weak. The solidity of the structure can only be restored by increasing the investment and decreasing the debt to a safe point. If we cease to maintain the power plant by interrupting the coal supply, the plant will soon stop its operations. If we cease to maintain the financial structure by stopping the returns to the investor, this will ultimately cease to function, and in turn the power plant will cease its operation. In either case the enterprise fails sooner or later and the public suffers.

Should Provide Stabilization Fund

The investor today is appreciating through lessons learned in the past that there is on hand no contingency or stabilization fund which will act as a reserve to provide for a return on the investment during periods of depression. Such a condition did not always exist. In the early days of the public service enterprise when the growth was comparatively slow owing to the newness of the art and rates for service were high and expenses low, many successful companies established a contingency or stabilization fund. In the later days of the exploiter this fund was used to furnish a return on securities issued but not represented by cash or services in the physical structure.

When the price fixing of service was put into effect, the importance of the contingency fund was not appreciated and its establishment was not permitted, and as a result, the value of common stock as a means of permanent financing, which is the foundation in any enterprise, was lost sight of. In an effort to continue to meet the demands of the public for extensions and additions to the physical structure, a stock was created which took a preference over this common stock, and on this the returns on the common stock acted as a contingency or stabilization fund. As the amount of preferred stock grew, such fund became inadequate to protect the preferred stock investor. At this point both classes of investors ceased further investment in the enterprise, which was then forced to borrow. All returns to the investor in common and preferred stocks now become the contingency or stabilization fund of the lender or bondholder. The point has now been reached, however, where in many cases even the requirements of the lender cannot be met and the financial structure as it now exists is once more in trouble.

Return on investment is not permanently fixed, but varies from time to time, depending upon money market conditions and investment risk. The basis upon which a stock sells may vary at time from 6 to 10 per cent or more, depending upon the market price of money and whether or not a loan is placed ahead and secured by the investment. The investor is compelled to assume the risk of a loan ahead of the investment in order to meet the demands of the public for extensions to the physical property at a time when, owing to money market conditions, the investment cannot be increased because the rate of return permitted has been fixed below market requirements. In this connection the public and the commissions compare the rate of return to the lender with that to the investor, without giving due importance to risk to the investor. The lender is secured in the loan not only by property represented by such loan but by all the property owned by the investor, while the investor has remaining only a conditional claim on the investment.

Then again the lender (bond or note holder) must ultimately be paid back, and there are only three ways in which the investor can accomplish this—first, by earnings or returns from service, which the public must pay; second, by the investor increasing his investment so that the lender can be paid off, an object that can be accomplished only when the investor receives a rate of return which will encourage such additional investment, this being the only plan, moreover, which will finally restore the financial structure to a permanent basis; third, by again borrowing to pay off the loan, which is the method adopted generally, but which involves a continual refinancing through loans either for short or long periods the expense of which must be recognized in the rate for service.

Relative Returns to Lender and Investor

The relative positions occupied by the lender and the investor in the financial structure are important in determining return. If the lender, or bondholder, demands a return of 5 per cent, then the preferred stockholder, or investor, should be entitled to a return of 7 per cent, the increase being commensurate with the risk, and the common stockholder, who assumes the greatest risk, should be entitled to a return of 10 per cent. These figures, however, are based on a loan extending over a long period during which the stockholders have an opportunity to take advantage of cheaper money to pay off the lender. If the loan is for a short period, the chance of protecting the investment is materially reduced, the investment becomes more speculative and therefore is entitled to more return.

Ratio of Bonds, Preferred and Common Stock

In a case where the financial structure is made up of 50 per cent in 5 per cent bonds, 25 per cent in 7 per cent preferred stock and 25 per cent in 10 per cent common stock, the return on the total capital would be somewhat less than 7 per cent, but if market conditions require a 6 per cent bond, 8 per cent preferred stock and 12 per cent common stock, the return on the total capital becomes 7½ per cent. This rate of return, however, is not the cost of money to the enterprise, and in this connection regulating bodies often err. To arrive at the cost of money to the enterprise there must be added to any return to the lender or investor all expense necessary to transfer the money to the enterprise, corresponding in a way to transportation of coal to the power plant. In addition to the cost of distribution of securities, which may vary over a wide range, financial expenses include cost of legal, accounting and engineering services, disbursements in connection with proceedings before regulating bodies, taxes on securities, printing or engraving of certificates and numerous other items which always accompany new financing. In the case of short-term bonds or notes where the loan is for a small amount the cost has in many cases exceeded materially the amount paid for interest. There are many instances on record where short-term financing has cost from 14 to 16 per cent and more, although the interest rate has been but 7 per cent.

Then again the cost of money depends to an extent upon the action of regulating bodies. The securities are created and marketed as money is required, under money-market conditions which are subject to change during the deliberation of the regulating bodies. In many cases in the past owing to the vast amount of detail work in the hands of the regulating bodies there have been delays in securing prompt approvals, during which time the cost of money has increased from 30 to 50 per cent.

Must Increase Sale of Common Stock

For the past five years public service enterprises have had all they could do to meet the constantly increasing cost of labor, coal and material by getting rate increases that enabled them merely to exist and continue as solvent concerns. It has not been possible, therefore, for the enterprises themselves, the commissions or the public to give full consideration to some of the broad questions which must now be fairly passed upon and settled if these enterprises are to continue to serve and satisfy the demands as to extensions. To return to a proper basis means not only that enough money must be earned to pay a cash return on the common stock which would make additional stock of this class salable in competition with other securities, but that common stock should be permitted some of the cash return which it has had to forego during the past five years. Otherwise investors will not be attracted to the enterprise, because it will be apparent that in another period of similar financial stress they will again be without any return on their investment. But, more than this, a contingency or stabilization fund must be built up to safeguard return.

Regulation Should Draw Investors to Utilities

There has been a widespread belief in many communities that recent rate increases are satisfactorily meeting all problems. This is not the fact. Such increases have barely been sufficient to provide for the increased cost of coal, labor and materials. The final problem to be solved is the renewed interest of the investor or stockholder and the gradual elimination of the lender or bondholder, and no enterprise can find this solution unless the investment of common stock is paying in cash a proper rate of return after provision for all reserves and contingencies.

If such a market is created, it will of itself create the best regulation. An enterprise whose common stock has been selling at premium for a substantial period can obtain capital for extensions so that all increased economies can be passed down to the public. It will then be the duty of the public service commission to see that all further economies are shared by the public and by the investor.

Unusual Industrial Heating Developments

Possibilities of Electrical Service of This Kind Shown by Variety of New Applications—Central Stations and Manufacturers Should Combine Efforts in Developing a Field Which Eventually Should Be as Large as Motor Load

By WIRT S. SCOTT
Manager Industrial Heating Section Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

THE electrical manufacturers apparently appreciate more fully than central stations the tremendous possibilities in the development of the industrial heating load, but they alone cannot develop this field. So far the electrical manufacturers have done the major part in the investigation and application work, at a considerable expense and with comparatively little help from the central-station companies, which in the long run will be the greatest beneficiaries, since the purchase of power goes on continually. The leading electrical manufacturers have organized separate departments for industrial heating work, are developing apparatus to meet the requirements just as rapidly as possible, and are training a corps of specialists for the development and handling of this comparatively new field of business.

It is only a matter of time until every central station throughout the country will have as many power salesmen engaged in industrial heating work as it now has on industrial motor work. The available business is there for the going after, and the character of load is almost ideal. If the electrical manufacturers, with their limited number of experts, can accomplish in one year the work that was accomplished during 1920, what could be accomplished in 1921 if each central station would put on specialists for the development of a field larger than the motor load—that of industrial heating?

Development of Electric Air Heating for Textile Mills

One of the most interesting and progressive steps made up to the present is the heating of a large textile mill electrically. It has been an accepted fundamental principle that electricity could not compete with coal for the heating of buildings. Recent investigations have been made, however, which show that electricity can compete with coal, taking all the facts into consideration, when energy is obtainable at 1 cent a kilowatt-hour and coal is $8 a ton.

The Canadian Cotton Company of Canada, after a thorough investigation and examination, has entered into a contract for the electrical heating of one of the new mills it is building at Milltown, New Brunswick. The building is 184 ft. (57 m.) wide by 410 ft. (134 m.) long, two stories high, and has an installed capacity of 2,200 kw. for maintaining a temperature of 65 deg. Fahr. within the building when the outside temperature is 20 deg. below zero.

A hot-air system of heating is employed, this being recognized as the most effective manner of heating the building, besides providing good ventilation at all times. During the summer the system may be operated as a strictly ventilating system without the heat being on. This does not interfere with the humidifying system usually employed in textile mills, and as a matter of fact it should result in a more uniform humidity being maintained.

The heaters are concentrated into two centralized systems, one for each half of the building, and are placed in housings similar to those used with steam coils, the air being drawn through the heaters by a suction fan and distributed through the building by means of vent pipes.

Electric contact-making thermostats are used for maintaining the temperature constant within narrow limits. These, in connection with magnetic contactors, hold the temperature constant, continually and entirely automatically, at 65 deg. Fahr. throughout the entire twenty-four hours, irrespective of the outside temperature. The installation is thoroughly safeguarded, so that in the event of the power going off the motor driving the exhaust fans the current is automatically cut off from the heaters. It is further safeguarded to the extent that if the temperature within the heater housing goes beyond a predetermined limit the heaters are automatically disconnected from the line. In the event that the temperature within the room should go beyond a given point owing to the possible failure of the controlling thermostats a separately operated thermostat will cause the sounding of a loud gong, which will be sufficient to attract the attention of the watchman day or night.

By the electric heating of mills, particularly where water power is available, an enormous opportunity is provided for conserving natural resources, especially coal. It is to be hoped that steps will be taken at once by those companies fortunate enough to operate plants deriving their power from waterfalls, or those that purchase power from water-power plants, to investigate the advantages offered by means of electric heating.

Electric Core Baking Showing Progress

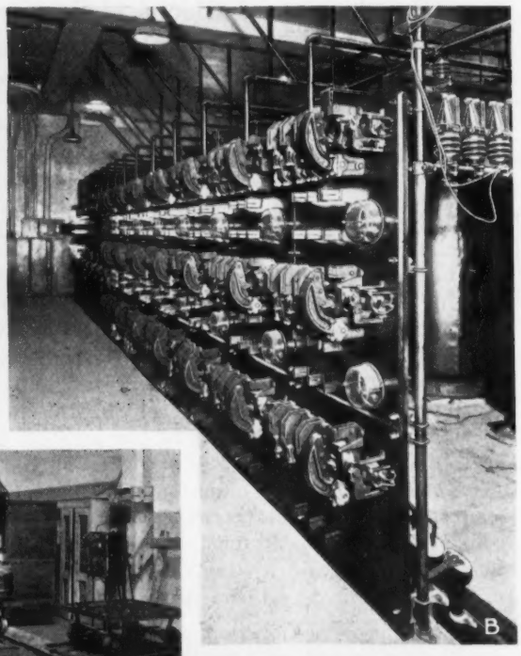
Scientific baking of cores has been almost an unknown subject in this country and through ignorance has resulted in a waste in labor, material and fuel. A visit to the foundries will demonstrate that not one-half of the core-baking ovens have thermometers on the ovens to indicate the temperature. Furthermore, very little attention is given as to the amount of ventilation required, and those who make a pretence of controlling it do so on a hit-and-miss basis.

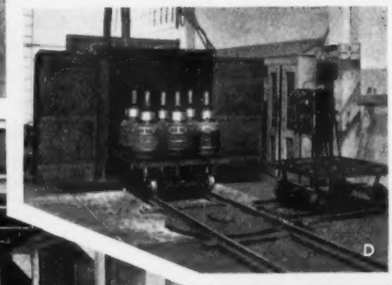
On the basis that there is one best operating temperature in any heating process, and that there is a definite best rate for heating up any piece of work to that temperature, attention has been turned to the core-baking field as virgin territory.

There has been comparatively little done in electrifying core-baking ovens in the past, owing primarily to the lack of specific data as to the advantages to be gained by heating core ovens electrically. There was

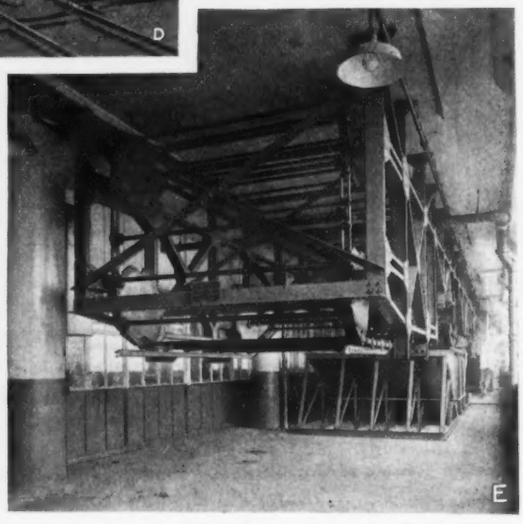
Electric Heating Is Becoming Very Important in Industrial Production Processes

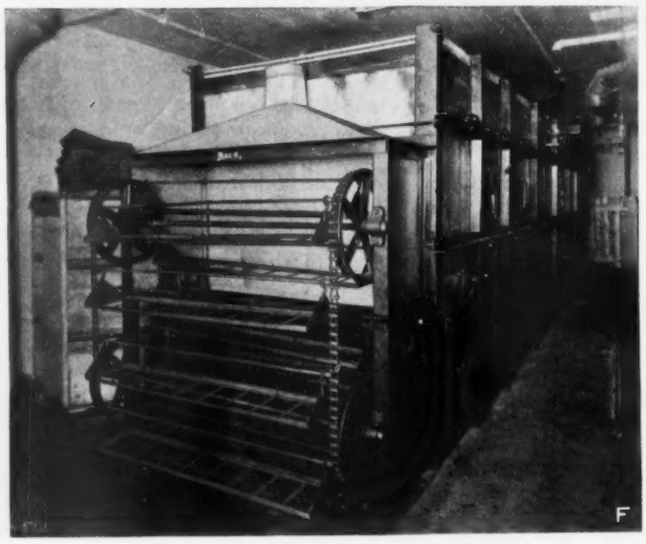
A


B


D

C


E


F

IN *A*, *B*, *C* and *E* are shown some details of interesting installations in the new plant of the Cadillac Motor Company. The instrument board *A* is for controlling and recording the temperature of the electric ovens, while *B* shows the circuit-control panel for the heating equipment, totaling 2,000 kw., in the enameling ovens. In *C* and *E* are shown inside and outside views of one of the continuous conveyor ovens. The oven is 12 ft. wide, 145 ft. long and 8 ft. high. The heater capacity is 450 kw. Parts to be enameled are hung from the conveyor bars at the top (*C*) and move through the oven after having been dipped in the enamel tank shown in the foreground of *E*.

The armature baking oven, shown in *D*, holds eighteen armatures, six being placed on each of three trucks. The continuous bread-baking oven shown at *E* is used by Fisher Brothers, Cleveland, Ohio. The bread moves through the oven continuously with a baking time of thirty-five minutes.

no questioning that it could be done, but there were almost no data showing the effect of baking cores electrically and scientifically.

The Westinghouse Electric & Manufacturing Company undertook the work of investigating the baking of cores electrically, carrying out this research work along lines of investigation made in connection with other baking processes which now have become standards for many industrial plants.*

The research department was placed in charge of the investigation work and a core-baking oven was purchased and installed in the brass foundry. Tests were run, extending over a period of six months, during which time cores of various mixtures were baked, with varying amounts of ventilation and at different temperatures.

The conclusion of these tests resulted in very strong recommendations being made by the process and materials department of the Westinghouse company for the adoption of electric heating in its brass foundry, with the result that the electric oven, which was purchased on an experimental order, has been taken over by the works and is now in daily operation.

Typical Uses to Which Electric Heat Can Be Applied

Tests show that the bread baked in an electric oven is much more uniformly baked than when a gas oven of similar design is used. The conveyor type of oven has found favor among commercial bakeries, Fisher Brothers, Cleveland, having an installation rated at 900 1.5-lb. or 1,350 1-lb. loaves per hour. The oven is equipped with fifty-six heaters rated at 140 kw. and 220 volts and has automatic temperature control.

Armature-baking ovens have been made for the purpose of determining the advantages in baking railway motor armatures electrically, with the result that process specifications have been prepared covering the complete method of handling armatures and field coils in order to insure the fullest benefit from electric heat. It was found that three sizes of ovens fill nearly all the requirements of the field. Beyond a certain size it is better to install more than one oven.

Many of these ovens have been installed during the past year, with the result that this method of baking is becoming quite extensively used. Tests have shown conclusively that a dipped and baked armature has a much longer life and that trips to the repair shop are greatly reduced in number. An electrically heated oven materially shortens the time a motor is out of service. Owing to the automatic temperature control there is no danger of overbaking.

An electrically heated oven does not require expert supervision in its installation or operation, as is shown by the fact that several have been installed by men who had never seen this equipment except in catalogs but are now operating the ovens with complete success in the baking of railway armatures, field coils and other apparatus.

Three noteworthy installations have just been completed for the baking of enamel on automobile fenders, hoods and other accessories at the plants of the Cadillac Motor Car Company, Detroit; the Packard Motor Car Company, Detroit, and the Buick Motor Car Company, St. Louis. The ovens at the Cadillac and Buick plants are of the continuous-conveyor type, the work being hung on an overhead moving conveyor which automatically carries the parts down into the dip tank of enamel, up the drain board, into and through the ovens, progressing through three ovens continuously for three-coat baking, without removing the work from the conveyor. In the Cadillac ovens there is an installation of 2,000 kw., and in the Buick ovens one of 1,600 kw. These ovens are maintained at 450 deg. Fahr. by means of automatic temperature-control equipment.

The Packard Motor Car Company installed an equipment which consisted of twenty-two semi-continuous conveyor-oven equipments, requiring a capacity of 3,120 kw. The temperature of each oven is automatically controlled. The Packard company previously had some twelve or fifteen electrically heated ovens in operation.

During the past year considerable experimenting has been done and much progress made in the development of reliable and satisfactory high-temperature heat-treating furnaces, with the result that there are now available electric furnaces for working temperatures up to 2,000 deg. Fahr. A 120-kw. furnace has been in operation for more than a year heat-treating automobile springs. It is operated at 1,560 deg. Fahr. Two tests made at different intervals show consumptions of 1,520 kw.-hr. for 15,000 lb. (6,800 kg.) of springs and 1,550 kw.-hr. for 16,330 lb. (7,400 kg.) of springs treated. Initial temperature of steel, 70 deg. Fahr. Weight of charge, 675 lb. (306 kg.).

One of the interesting applications has been the annealing of hotel glassware in a 72-kw. furnace at a temperature of 1,200 deg. Fahr. This furnace is 22 in. wide, 10 ft. long and 5 ft. high (56 cm. x 3 m. x 1.5 m.), of the overhead-conveyor type. Several thousand goblets were annealed, the goblets being placed in metal containers consisting of nine trays, each tray holding twenty-five goblets, five in each row and five rows deep.

Special Heat-Treating Applications

During the war period 3,500,000 safety springs for shrapnel fuses were heat-treated in an electric furnace at a temperature of 1,200 deg. Fahr. without a single rejection and without reheating any batch. The shrapnel-fuse springs were heat-treated in brass tubes into which was poured approximately one teaspoonful of water. Conversion of the water into steam prevented oxidation. Approximately 550 lb. of brass, including container tubes, was heat-treated every twenty minutes. Hand control was used, consisting of a transformer having a large number of taps, with radial knife switches. The temperature and time of heating were announced by a specially built alarm clock ringing at irregular predetermined periods, such as one minute, three minutes, two minutes, at which times the operator placed the radial switches in certain predetermined contact positions. With a fuel-fired furnace an exact, predetermined, step-by-step temperature control is impossible, and it was only by the use of the electric furnace, in which the heating was done on all four sides, bottom, top and sides, that the results as above outlined could be obtained.

An electric furnace is in operation heat-treating approximately 4,000 lb. of brass per week for the United States government. This is the only type of furnace which can uniformly control the crystallization of brass according to rigid specifications of the United States.

Fusing bifocal lenses must be done at a critical temperature, requiring a uniform temperature to pre-

*The results of these tests are shown in an article, "Electrifying the Foundry Core Room," by J. L. Jones, in the Dec. 18, 1920, issue of the ELECTRICAL WORLD.

vent resulting strains and a clean atmosphere to prevent spoiling the polished faces of the lenses being fused. The lenses are placed on small plaques, four per plaque, and each plaque is covered with a vitreous enameled-steel square cup, fed automatically through the furnace chamber and discharged into an annealing lehr. The furnace chamber is in four sections, two sections 18 in. (45 cm.) long, each maintained at a different temperature. The annealing lehr is 60 ft. (18 m.) long.

When the work was carried on originally through gas-fired furnaces the loss was approximately 20 per cent, whereas the average loss now is 3 to 4 per cent electrically treated.

Tests were made to determine the practicability of using an electric furnace for vitreous enamel kitchenware. Thirty-six miscellaneous pieces were fired in the furnace, and a most careful inspection showed that the results were perfect as to polish, absence of pitting and general smoothness. Owing to the ease with which a definite temperature could be maintained it was a very easy matter to secure results of the highest order, with almost no attention.

Among the numerous reasons advanced for the phenomenal development of electric heating are the following: No combustible gases are generated in the electric furnace; no stacks are required, therefore the efficiency is much higher than in furnaces of the combustion type; there is no escaping gas, no odor and no smoke from the electric furnace.

Power Possibilities of Austria*

Total Water Power Capable of Development in That Country Is Estimated at 1,500,000 Hp.—New Republic Has 460 Stations

BY J. SEIDENER AND A. GRUENHUT
Editors *Elektrotechnik und Maschinenbau*, Vienna

IN A PREVIOUS article (ELECTRICAL WORLD, Nov. 27, 1920) the effect of the war on the electrical industry of Austria was shown, and the statement was made that the markets of east Europe could be reached more cheaply from Austria than from the United States. As a result it was maintained that the opportunities for American capital are promising.

While the new Austrian Republic is lacking in minerals, and particularly coal, there is an abundance of undeveloped water power. Excluding western Hungary and the district of Kärnten, there is available 1,500,000 hp., not including sources rated under 1,000 hp. Estimated total water power may be put at 3,000,000 hp. Of the 1,500,000 hp. available only about 150,000 hp., or 10 per cent, is being utilized at present.

Other sources of energy are only available in the form of small amounts of inferior coal. These deposits are so small that they will be consumed in fifty to sixty years at the present rate of demand. There are no petroleum or natural-gas resources.

For the determination of the power requirements the consumption of coal will be considered first. A total of 1,156,000 tons of coal and 110,000 tons of coke is needed per month, which equals 15,500,000 tons of coal per year. The yearly output of Austrian coal being about 2,200,000 tons, 85 per cent of the coal needed must be imported. An investigation of the main power consumers—first, the power houses of Vienna; second, the combined industries, and, third, the main railway lines of the republic—shows a possible replacement of caloric power by hydro-electric power of respectively 450,000 tons, 3,000,000 tons and 1,200,000 tons, or a total of about 4,500,000 tons.

If it be assumed that this replaced coal consists of 50 per cent anthracite and 50 per cent low-grade coal, 3.3 lb. (1½ kg.) of this mixture will be required per horsepower-hour, or, calculated on a basis of 3,000 operating hours, a total of about 900,000 hp. If it be assumed that the coal to be replaced by hydro-electric energy is full-grade anthracite with a heating value of 11,400 B.t.u. per pound (6,000 calories per kg.), giving 1 hp.-hr. per 2.2 lb. (1 kg.), a similar calculation would result in a total of 1,350,000 hp. To these figures a total of about 100,000 hp. would have to be added to take account of power generated by gasoline and crude-oil motors in small industries. This all sums up in a grand total of about 1,000,000 hp. of hydro-electric energy required for the republic.

DEVELOPABLE WATER POWERS OF THE AUSTRIAN REPUBLIC

This tabulation shows a rather high average per square mile and also a decided decrease toward the east.

	Hp.	Area in Sq. Miles	Hp. per Sq. Mile
*Lower Austria	231,800	7,150	32.4
*Upper Austria	314,700	4,630	67.8
Salzburg	111,450	2,760	40.3
Steiermark	294,850	6,220	47.4
Kärnten	146,200	2,900	50.4
Tirol	302,600	4,940	61.2
Vorarlberg	85,000	1,000	85.0
Total	1,486,000	.....	Avg. 55.0

*Including the Danube

STATUS OF THE GENERAL ELECTRIFICATION

The amount of 5,000,000,000 crowns has been appropriated by the government as an investment for five years for railway electrification. The salient points of the railway program are a single-phase system with 15,000-volt trolley line at 16⅔ cycles, such as is used successfully in Germany, Switzerland and Sweden; express locomotives of 3,000 hp. and 116 tons weight with 37 miles (70 km.) per hour maximum speed, and local passenger-train locomotives of 1,000 hp., 68 tons and 35 miles (65 km.) per hour maximum speed. A stretch of line in the Alps covering 404 miles (651 km.) will be electrified first, saving about 350,000 tons of coal per year. Later the 1,110 miles (1,788 km.) of main line will be electrified, a development which will require twelve to fifteen years to complete.

POSSIBLE SAVING IN COAL BY ELECTRIFICATION OF RAILWAYS AND INDUSTRIES

	Tons
Roads	1,200,000
Industries	2,700,000
Vienna	500,000
Total	4,400,000

A number of hydraulic power stations are to be erected near Vienna with the financial help of the city, the state of Lower Austria and possibly the State Railways and Danube Commission. To assist this action three new companies have been already formed, each holding franchise rights on water powers south of Vienna. Obstacles to the rapid progress of this large

*This article was contributed by the authors exclusively for the ELECTRICAL WORLD.

program are the present lack of raw materials and coal, the difficulty of financing and a desire on the part of certain states to separate from the republic.

The ultimate realization of complete electrification of the roads and industries of Austria would mean in round figures the saving shown in the table.

Under the most favorable conditions three-tenths of the total requirement of coal will, therefore, be replaced by hydro-electric power.

CENTRAL-STATION DEVELOPMENT

Before the war the Austrian monarchy had 931 electric generating stations with a total rating of 540,000 kw. The republic has 460 stations with a total rating of 298,000 kw. Twenty new stations are under construction or will soon start operation. Of the total number 168 are operated by the communities in which they are situated, while 292 are in private possession. Service is supplied to 1,300 towns with a total population of 4,200,000. It may be assumed, therefore, that about one-third of Austria's population has no access to electric lines. These stations give occupation to 3,500 persons and represent an investment of 400,000,000 crowns. The number of small plants of less than 100 kw. and mostly operated with direct current is 300, or 70 per cent of the total number, but their output is only 4 per cent of the total. About 85 per cent of the energy is generated in 200 plants of more than 1,000 kw. capacity each, using exclusively three-phase, 50-cycle alternating current. Owing to the copper shortage during the war a great number of direct-current plants changed over to alternating-current, so that at present the direct-current plants represent barely 3 per cent of the total capacity.

VOLTAGES USED IN AUSTRIA

Approximately 70 per cent of the total output is generated in seventy plants at 5,000 volts and 7 per cent in fifty-nine plants at 3,000 volts, while 6,000 volts is used in a few plants. Transmission tensions used as standards are 10,000, 15,000, 25,000 and 35,000 volts. Stations using 100,000 volts are now under construction. Service voltage is two-wire, 220 volts, on direct-current networks and 380/220 volts on alternating-current lines with grounded neutral. The use of direct current at 110 volts is rapidly decreasing. About 85 per cent of all the plants are water-driven, and only one-third of these have a steam reserve. About 15,000 hp. is generated by gas or Diesel motors.

MUNICIPAL POWER STATION OF VIENNA

The municipal power station of Vienna is the most important and largest central electric station in Austria. Shortly before the war the last private plant had been taken over by the city, so that since that time not only all the power for the street railways but also 90 per cent of the light and power of Vienna has been furnished by the municipal plant. There were three generating stations in Vienna at that time, with machines totaling 172,000 hp. They served 450,000 consumers with a connected load of 280,000 kw. During the year 1914-1915 a total energy of 220,000,000 kw.-hr. was generated.

To utilize the low-grade coal mined 23 miles (38 km.) south of Vienna at Ebenfurt a power house was erected at the mouth of this mine and designed originally for 16,000 hp.

During the first months of the war the use of energy decreased. Soon, however, owing to the intense operations of war industries, the output increased rapidly, reaching a maximum of 280,000,000 kw.-hr. during 1917-1918. An increase in power of 20 per cent and a decrease in lighting of 11 per cent were noticed. The decrease in lighting was caused by the daylight-saving system and by ordinances imposing economy.

After the collapse of the monarchy conditions rapidly became worse, and during the year of 1918-1919 practically no coal reached the Viennese plants, the plants being, in consequence, thrown entirely upon their reserves.

Because of lack of workmen the plant at Ebenfurt had to be stopped almost entirely, and more drastic regulations for the use of light, and even of power, had to be imposed upon the consumers. While it has been possible to bring the Ebenfurt plant back to normal, and even to increased, output, foreign coal deliveries to Vienna have improved very slowly, and owing to their irregularity all ordinances in the interest of economy were left unchanged.

During the year 1919-1920 a marked increase of the connected load was made, and to meet all the demands would have required a total generation of 320,000,000 kw.-hr. Owing to the many and rigorous restrictions only 210,000,000 kw.-hr. could be delivered, or 35 per cent less than needed.

METHODS USED TO SOLVE POWER SHORTAGE

Several measures have been put in force to relieve the serious power shortage at Vienna. The first of these was an increase in the output of the Ebenfurt plant. New coal beds were opened up, a double shaft was sunk, and the total machine output was increased to 28,000 hp. The transmission voltage between this plant and Vienna will soon be raised from 35,000 to 70,000.

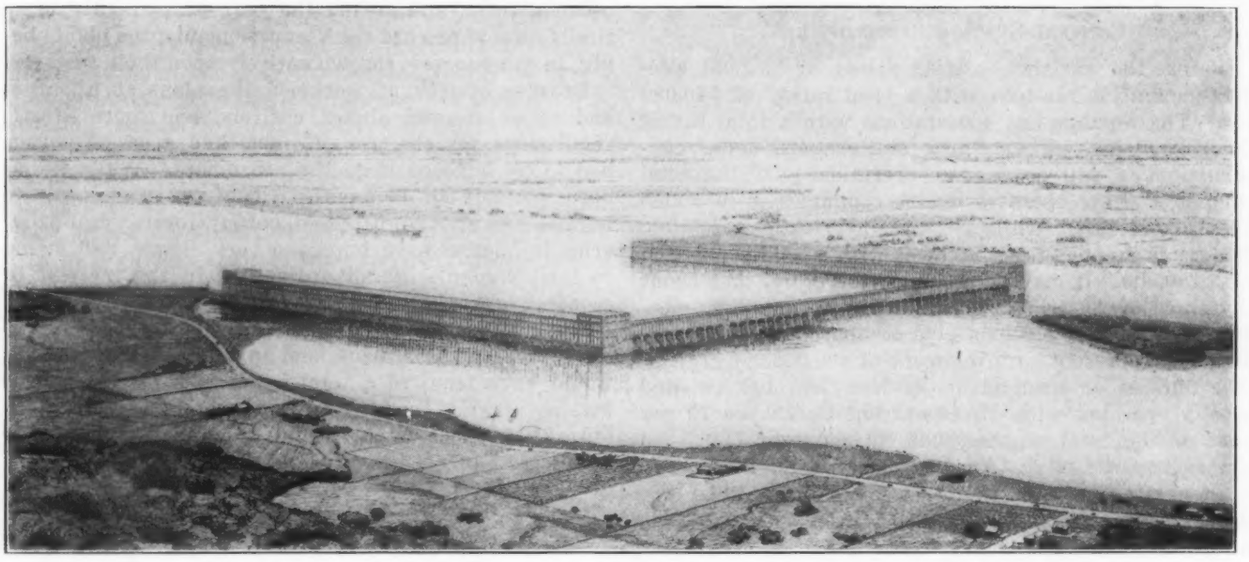
The grates of the boilers at Vienna will be changed over to use the low-grade coal from the Ebenfurt mines. Four modern steam turbines of 12,000 hp. to 16,000 hp. each will replace old reciprocating engines. The first of these is already in operation; the second should be in operation soon. Twelve boilers of the power house were changed over to oil firing. Several small hydro-electric plants near Vienna were tied in to the main 70,000-volt transmission line.

All these measures will soon make it possible to reduce the need for foreign coal to the small quantity at present available. The ultimate idea is to make Vienna totally independent of imported coal by increased production of Austrian coal and the addition of all available water power. Every possible means is being used to make this relief an actuality and thus render the repeal of the restrictive ordinances possible.

THE *commission in fixing a rate of return must be liberal, lest too strict a policy result in turning capital to other fields of enterprise. The commission's policy should be a broad and liberal one, so as to encourage capital to develop the state by legitimate public utility enterprises where needed. The commission should be careful not to permit an inflation of prices in ascertaining the value of the property of a public utility used and useful for the public purpose, but should be liberal in establishing the rate of return on that value.*—From decision of California Railroad Commission.

5,000,000 Hp. Available from St. Lawrence*

Joint Development of This Power and Locks Around the Dams Will Create 30-Ft. Channel from Great Lakes to Sea at 27 per Cent of Expenditure Required for Improving Navigation Alone—Methods of Conducting, Time Required and Market for Power



ARRANGEMENT OF DAM AND POWER HOUSES PROPOSED FOR DEVELOPMENT AT CROIL ISLAND

MOST suggestions for utilizing the power of the St. Lawrence River have made no provision for improving navigation of the river as a whole, despite the fact that nothing helps to develop a market for electrical energy more than good transportation facilities. However, a plan is now suggested whereby 5,000,000 hp. may be developed and a 30-ft. (9-m.) waterway provided at the same time for freight that must be transported between the Great Lakes and the Atlantic Ocean. By this joint development plan, and by this plan only, it is claimed that the navigation facilities can be provided for $150,000,000, or only 27 per cent of the expenditure that would be required if improvement of navigation were undertaken alone.

The proposed development involves the construction of five dams with a generating station at each end of each dam (an arrangement essential to the handling of the great ice flows of the St. Lawrence), the provision of a lock at each dam, and the deepening of the channel at the head of the Golops Rapids at the Long Sault and at Farran's Point. The dam which it would be most logical to construct first would be located near Croil Island, about 33 miles (53 km.) below Lake Ontario; the second would be installed near Massena Point, N. Y., about 15 miles (24 km.) farther downstream; the third would be about 44 miles (70 km.) farther along, near Cedars, Quebec; the fourth about 4½ miles (7.2 km.) below, near Cascades Point, Quebec, and the fifth about 20 miles (32 km.) downstream, near Côte St. Paul, Quebec. Approximately 40 ft. (64 km.) of head would be developed at each plant, the aggregate head being 196 ft. (315 km.). Locks would be provided at each dam to the total of six and would involve 3½ miles (5.6 km.) of canal.

The entire development, it is estimated, will cost approximately $1,300,000,000. The initial installation, 400,000 hp. of the Croil Island development, can be completed within five years. The remaining 600,000 hp. from this site can be installed in blocks of 50,000 hp. upon twenty months' notice as and when the demand for power requires it. Plants at the other four water-power sites can be constructed by the electric service companies now operating in the vicinity of them or can be installed by others. To recompense the existing operating companies which would be deprived of water they now use, they might be provided gratis with an amount of power equal to what they are now developing by the company, which would operate a new plant at the site. Development of plants Nos. 3 and 4 would provide 2,000,000 hp. for public consumption, compared with the 160,000 hp. now developed in the vicinity of these sites.

According to careful estimates, power can be made available to consumers from the proposed Croil Island development at $17 per horsepower-year. To judge whether there will be any difficulty in securing a market for the power made available, it is only necessary to compare the parallel development of industry and electric service facilities during the past few years. In general it can be said that industries will locate where price or reliability of power, availability of labor, railroad facilities and proximity to their market are most favorable. All of these requirements, especially those relating to power and transportation, will be met if the proposed joint development is completed.

The actual undertaking of this development cannot

*Statements extracted from a report which has been recently submitted to the International Joint Commission on navigation and power development of the St. Lawrence River between Lake Ontario and Montreal by Hugh L. Cooper & Company.

be expected to become an immediate reality, however, unless the governments of Canada and the United States, which have jurisdiction over boundary water-power development, will recognize the relative benefits of the proposed plan, will wave duties on construction materials and restrictions on labor, will consent to free interchange of power, and will allow rates for power which will be commensurate with the unusual financial and engineering factors involved. Furthermore, each government must provide, operate and maintain all navigation facilities and adjust all damages resulting from changes in water elevations.

Collectively, the Great Lakes, Niagara River and the St. Lawrence River are the largest undeveloped resources of their kind in the world, yet the ratio of present power development on these boundary waters to the ultimate possible is negligible. At present only about 850,000 hp. is developed at Niagara Falls, whereas at least 2,305,000 hp. can be developed without marring the beauty of the Falls. This additional available power plus the 5,000,000 hp. which can be developed as proposed on the St. Lawrence would provide a total additional 6,625,000 hp., or 66 per cent of the total water-power horsepower installed in the United States. Owing to the more constant flow of the Niagara and St. Lawrence Rivers, this power could be developed at 25 per cent higher load factor than the average in the United States and thus produce the equivalent of 82 per cent of the energy now generated by water power in this country.

Considering this enormous amount of available hydro-electric energy, increased importance should be attached to the following advantages of water-power development:

(a) Every 35 hydro horsepower which is developed releases one laboring man's efforts for one year for more profitable engagement. This means that 190,000 men would be made available by the proposed development for other business, say agriculture and industrial.

(b) Seventy times more labor is required to produce a given quantity of steam-electric power than to give the same quantity of hydro-electric power. This takes into consideration labor required in the mining of coal used as well as generating-plant personnel.

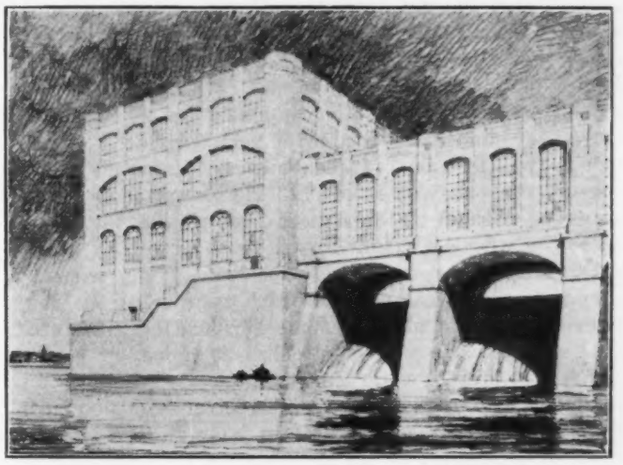
(c) Every hydro horsepower saves on the average more than 10 tons of coal per annum, or 66,250,000 tons in this case.

(d) Hydro-electric energy saves every consumer $35 per horsepower-year on the average, or $231,875,000 based on the proposed developments. This alone would justify an expenditure of $1,932,000,000 if capitalized at 12 per cent, the average return on industry before the war, or more than the proposed canalization and power development of the St. Lawrence River would cost.

(e) Water power reduces freight rates on general commodities through saving of coal and releasing railroad property and equipment for more productive uses. More specifically, 36,000 freight cars and 600 locomotives, valued at $141,000,000, would be released by this development, to say nothing of other railway property used solely in connection with this coal equipment and amounting to an additional $530,400,000.

Aside from the foregoing advantages would be the increased speed of traffic in the St. Lawrence River and the reduced rate per ton, the development of new industries, the reduction of coal exports to Canada and hence its greater availability at a lower ton cost in the United States and the increased business on the Erie Canal which would result from new industries.

According to records of recent traffic on the St. Lawrence River, it would require a tax of $6.66 per ton to cover the annual charges on the investment which would be required for an independent development of the navigation facilities. If this traffic could be quintupled by the improved facilities, which is possible, the tax would be $1.32 per ton; but this is prohibitive. The same traffic would have to be taxed only 36 cents per ton



DOWNSTREAM SIDE OF DAM WITH END OF POWER HOUSE ON LEFT

(about one-quarter as much) if the improvement of navigation should be accomplished jointly with power development as proposed.

The creation of a vast water-power zone, with the transportation facilities proposed, coupled with the existing excellent railroad facilities, nearness to large centers of population, sources of labor, supplies and so forth, would attract great chemical and fertilizer plants and other industries to which cheap reliable electric service is of paramount importance. The employment of labor and the circulation of wealth created by the production of these new industries would benefit not only the ten million industrial and agricultural people between the fortieth and fiftieth parallels but all North America. Based on the past relation between industrial growth and power development, the installation of 6,625,000 hp. could be expected to carry along with it the investment of at least $2,000,000,000 in new taxable industries. Including the investment in the hydro-electric plants, an outlay of $3,300,000,000 would be caused.

In some persons' minds, the report states, the question may arise, "Should the proposed development be financed, constructed and operated by private or by public capital?" The answer is emphatically that nothing should be undertaken by a government agency which can be accomplished by an intelligently regulated private agency. Despite the fact that there are some very able men in government service, they are in the minority, and energy and initiative are usually wanting or dormant in government undertakings. More zeal is usually devoted to holding jobs than to the execution of the work. Besides, there are some unusual financial and engineering problems involved in this proposed development which require unity of direction by men whose past achievements prove them amply capable of handling this undertaking. The best results can be obtained through competitive plans submitted by private capitalists and engineers.

Among the major engineering problems are the diversion of the St. Lawrence River by cofferdams, which

must be substantial enough to serve five years (the period of construction), preventing ice trouble and regulating the flow of the river. Four and one-half times the maximum amount of water ever diverted before—180,000 cu.ft. (5,000 cu.m.) per second—will have to be handled by cofferdams. To prevent ice troubles two principal methods are proposed: (1) By storing water for flushing the ice during the winter and early spring, and (2) by special construction and arrangement of each plant. The storage will be provided by regulating the level of Lake Ontario from the Croil Island dam so that 100,000 cu.ft. (2,800 cu.m.) per second extra is available continuously for 265 hours or in greater quantities for shorter periods if desired. Ice trouble will also be reduced or even eliminated by the construction shown, in which the power houses are arranged parallel to the stream flow so that water will enter the wheels at right angles to the river. Rugged, substantial piers extending upstream from the dam would serve to break any ice which approaches the dam. Provisions would also be made for heating the gates, gate seats, etc., to prevent attachment of ice.

Without stored water for flushing ice, the low unregulated flow of the St. Lawrence River—160,000 cu.ft. (4,500 cu.m.) per second—might be reduced to 60,000 cu.ft. (1,600 cu.m.) by ice as compared with the 224,000 cu.ft. (6,200 cu.m.) which may be obtained continuously with Lake Erie and Lake Ontario regulated or 217,000 cu.ft. (6,000 cu.m.) with only Lake Ontario regulated.

Water for regulating the flow of the St. Lawrence River would be obtained by controlling the level of Lake Ontario from Croil Island dam. The storage would permit momentary withdrawals of 280,000 cu.ft. (7,800 cu.m.) per second to carry peaks. All the plants might be expected to operate at approximately 80 per cent load factor. Thirty-six 17,000-hp. units would be installed in each station, the extra capacity above 50,000 hp. being provided to meet demands during reduced heads.

Correcting Wattmeter Readings for Phase-Angle Errors

Calculations Are Greatly Shortened by Use of a Chart—Method Is Particularly Good for Low-Power-Factor Measurements

BY E. D. DOYLE
Electrical Testing Laboratories, New York City

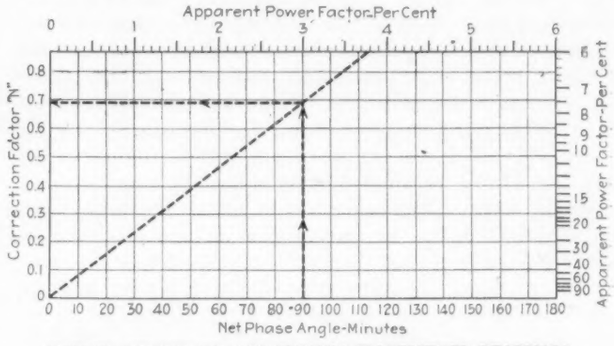
THAT wattmeters read incorrectly on low-power-factor circuits because of the phase angles of the wattmeter and the instrument transformers is generally recognized, and several methods of correction have been proposed.* These methods, however, are unsuitable for such low-power-factor measurements as are encountered in measuring losses in current-limiting reactors, high-voltage cables, and similar apparatus. The accompanying chart, devised by the writer in connection with some work at the Electrical Testing Laboratories, has proved very satisfactory in practice. The method is readily understood by reference to the chart and accompanying examples.

To make wattmeter corrections proceed as follows:

(1) Determine the net phase angle due to the reactance in the potential circuit of the wattmeter, the voltage transformer and the current transformer by reference to data from actual tests. Consider the wattmeter potential circuit phase angle as positive if inductance predominates and negative if capacitance predominates. Likewise the potential transformer phase angle is considered positive if it is an angle of lag and negative if an angle of lead. For the current transformer phase angles, however, an angle of lead is to be considered positive.

(2) Add the three angles and call their sum the net phase angle; express the result in minutes.

(3) Lay a straight edge on the curve from the point *O* to the apparent power factor; that is, the power factor



USEFUL CHART FOR CORRECTING WATTMETER READINGS

Examples:

(1) Apparent power factor, 3.78 per cent.
Net phase angle, 1 deg. 30 min. = 90 min.
Correction factor = 0.69. Multiplying factor = 0.31.

(2) Apparent power factor, 3.78 per cent.
Net phase angle, 0 deg. 9 min.
(Multiply by 10, work the same as first example and divide by 10.)
Correction factor = 0.069. Multiplying factor = 0.931.

as determined from the instruments in the secondary circuits of the instrument transformers.

(4) Follow up the required net phase-angle line to its intersection with the straight edge and then follow horizontally to the correction-factor scale. The correction factor is to be considered positive if the net phase angle is negative and the power factor is lagging, or if the net phase angle is positive and the power factor is leading. It is negative if the net phase angle is positive and the power factor is lagging, or if the net phase angle is negative and the power factor is leading.

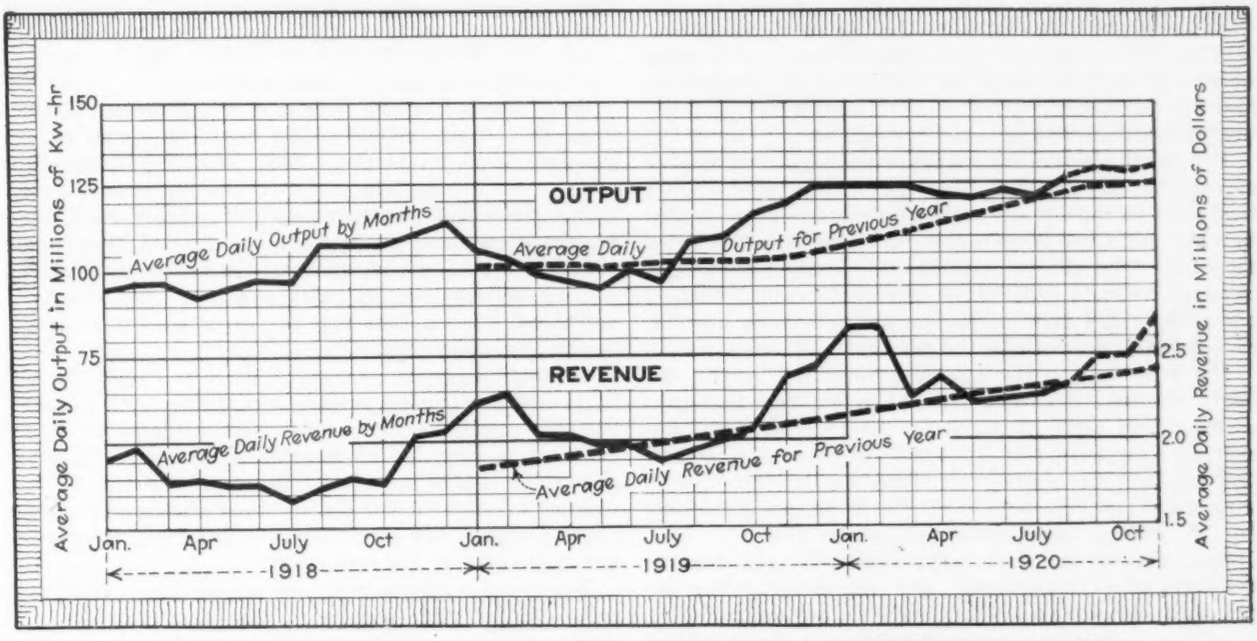
(5) Add or subtract the correction factor from 1, depending on its sign, and multiply the observed wattmeter reading, corrected for scale error, by this factor. Where the net phase angles are small and it is desired to read the correction factor with a higher degree of accuracy, multiply the phase angle by some factor, preferably 10 or 20, obtain a correction factor and divide by the same factor as was used as a multiplier before adding or subtracting from 1.

It will be noted that the chart goes up to 180 minutes—that is, 3 deg. An analysis of a large number of tests of current and voltage transformers shows that this range is more than ample. The only phase angles larger than 3 deg. which have been encountered were at 10 per cent load on current transformers, and they constituted less than 1 per cent of all that had been tested. In addition, both voltage and current transformers usually have leading angles which partially compensate each other. The largest phase angle which has been encountered in wattmeters has been less than 5 minutes at 60 cycles.

This chart may readily be copied, but the proof of its construction is beyond the scope of this article.

*Additive method of Dr. C. V. Drysdale (*Electrician*, London, Vol. 46, pages 774 to 778, 1901, and Vol. 76, pages 523 to 525, 1916), and the multiplying method given in the American "Handbook for Electrical Engineers," first edition, pages 1819 to 1822.

Record Output and Revenue in Spite of Industrial Depression



CENTRAL STATION INDUSTRY AS A WHOLE REPORTS RECORD OUTPUT AND REVENUE DURING NOVEMBER

THAT the central-station industry in general is riding the storm of industrial depression in a most gratifying manner is indicated by returns of central-station operations received by the ELECTRICAL WORLD for the month of November. A national record of 129,000,000 kw.-hr. average daily output was hung up in November, which is 700,000 kw.-hr. greater than the former high mark, established during the previous September. The total output was also 11.5 per cent greater than that reported in November, 1919.

Perhaps the most remarkable and gratifying fact, however, is that during a period when practically all other industries were curtailing operations on account of decreased income the central-station industry actually established a record for gross revenue. The figure of $2,710,000 average daily revenue recorded during November is 3.1 per cent greater than the previous record figure of $2,630,000, reported in January, 1920.

The demand for electrical energy for power purposes decreased on the average about 20 per cent below normal, but some industrial centers reported that energy sold to power customers during November was curtailed as much as 66⅔ per cent. Industrial curtailment was not, however, the only source of decreased energy requirement. In virtually all the Northern States a large number of office buildings and department stores run their own plants between October and April, during which period the demand for exhaust steam for heating enables them to operate their generating equipment economically. Notwithstanding these large deficiencies in energy requirements, seasonal increases in the lighting and heating load were sufficient to overcome the largely decreased industrial load except in a few highly industrial centers and in the Mountain and Pacific sections.

In New England large industrial curtailments were general throughout almost all industries. In the textile industry more than 2,680,000 fewer spindles were operating during November than during a similar period in 1919, and other large industries, such as the shoe industry, reported even more extensive cuts in factory operations. Yet the increased lighting and heating load was such that only a few central stations reported a decreased output for the month, and the average daily output of the section as a whole was slightly greater than that of October.

Notwithstanding the fact that in New York State

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy			Percentage of Installed Ratings Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
Dec.	59	$44,125	$37,978	16.0	65	2,509,571	2,270,833	10.0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25.3
Mar.	65	46,155	36,840	25.0	70	2,698,890	2,103,587	28.0
April	65	45,547	36,541	24.5	70	2,603,692	2,098,559	24.1
May	65	43,888	35,512	23.4	70	2,631,560	2,179,916	21.2
June	66	44,434	35,528	24.5	71	2,630,831	2,175,645	20.2
July	66	46,608	36,265	28.5	71	2,677,131	2,234,215	20.0
Aug.	66	47,410	36,713	29.1	71	2,769,175	2,303,099	20.1
Sept.*	66	49,224	38,209	28.5	71	2,734,179	2,327,460	17.4
Oct.†	66	51,299	41,026	25.3	71	2,800,515	2,500,166	12.0
Nov.‡	66	53,844	44,278	21.5	71	2,748,311	2,469,738	11.5

* Includes estimates for twenty-six companies, representing 6 per cent of the total installed rating of all central stations.

† Includes estimates for thirty-five companies, representing 7.9 per cent of the total installed rating of all central stations.

‡ Includes estimates for seventy companies, representing 14.7 per cent of the total installed rating of all central stations.

alone more than 150,000 out of 359,000 persons employed in factories in a selected list of industries were idle, and that iron and steel operations in Pennsylvania were decreased, yet with but few exceptions every central station in the Middle Atlantic States reported increased output over October, and in many cases a record output. In the cotton states there were 165,395 fewer active spindles than during November, 1919, and ore mining was considerably curtailed. Increased lighting and heating requirements in the Atlantic States as a whole were sufficient, however, to record a central-station average daily output greater by almost a million kilowatt-hours than was reported for October.

The North Central section reported the largest aggregate gain of any section. Even the most intensely industrial centers showed only a small drop in output under October, and some large industrial cities showed a large increase. The central stations supplying mainly the country districts reported a largely increased output, and the average daily output for the section as a whole exceeded any previous record for that section.

The growing importance of the industrial load in the South Central States is evidenced by the fact that notwithstanding large increase in the lighting load, the average daily output of 8,500,000 kw.-hr. was less than that reported for October by 200,000 kw.-hr.

Industrial curtailments in the Pacific States, a slackening in mining operations throughout the Mountain States, greatly decreased operations in the lumber industry of both sections, and decreased irrigation pumping load by reason of heavy rains, account in a large degree for the decreased average daily output of the central stations in the Mountain and Pacific States during November. Some large industrial centers in this section reported increased output over October, but this was overcome by largely decreased output in other centers and in the mining regions.

Readers' Views and Comments

Efficiencies of Low-Head Plants

To the Editor of the ELECTRICAL WORLD:

SIR: In the Dec. 25 issue of the ELECTRICAL WORLD, page 1260, appeared an article by L. E. Ayres on developing low-head plants. This is a very interesting article, but I question some of the statements. Mr. Ayres points out that turbine efficiencies have been increased about 10 per cent during the past twenty-five years and that where an increase of 10 per cent is possible by replacing old with new turbines at least an additional 15 per cent may be expected from a well-designed modern setting.

In his illustration marked Fig. 1 he shows the old horizontal quadruplex units in comparison with a single-runner installation and states that at least 20 to 30 per cent is expected as a gain in efficiency. I would like to ask if it is not a fact that the quadruplex setting was for wheels that had already been in use over twenty years and had thus seen their best days and were worn out and ready for the scrap pile.

Mr. Ayres makes a point of the saving in length of penstock, but says nothing of the greater width and depth necessary. It is generally known that water to be efficiently handled must be within certain velocities, and this dictates the capacity of waterways. Thus if you save in one direction by length, as noted in his article, it must be made up for by greater width and depth. From his illustration, Fig. 1, again, the elevation of bottom

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Installed Ratings Represented	New England States 1919 Thousands	New England States 1918 Thousands	New England States Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1919 Thousands	Atlantic States 1918 Thousands	Atlantic States Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1919 Thousands	North Central States 1918 Thousands	North Central States Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1919 Thousands	South Central States 1918 Thousands	South Central States Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1919 Thousands	Pacific and Mountain States 1918 Thousands	Pacific and Mountain States Per Cent Increase
REVENUE	Dec.	73	$4,908	$4,254	15.1	57	$15,926	$13,806	15.8	49	$11,660	$9,833	18.3	44	$2,496	$2,070	20.0	77	$9,135	$8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	5,635	4,718	19.8	59	17,659	14,625	20.9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb.	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar.	82	5,136	4,044	27.0	63	17,696	14,299	23.7	57	13,270	10,469	26.5	54	2,910	2,287	27.8	79	7,148	5,741	24.2
	April.	82	5,087	3,943	29.0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,118	5,992	19.2
	May	82	4,897	3,741	30.1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32.0	79	7,067	6,147	15.1
	June	82	4,948	3,778	30.5	65	16,525	13,449	22.1	57	12,412	9,776	26.9	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,689	4,623	22.9	65	19,205	15,724	22.0	57	14,458	11,667	23.9	54	3,504	2,551	36.9	79	8,443	6,461	31.0
	Nov.	82	5,917	5,014	15.5	65	20,876	17,080	22.2	57	14,795	12,497	18.1	54	3,793	2,905	30.2	79	8,463	6,782	24.5
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	Dec.	73	180,493	152,304	18.0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb.	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar.	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April.	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905 872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,512	190,727	3.1	66	964,550	842,535	14.1	74	896,241	817,757	9.5	56	157,267	126,769	24.0	79	585,945	522,378	12.0
	Nov.	82	193,567	183,151	5.9	66	953,196	825,452	15.9	74	896,944	829,452	8.1	56	143,468	124,280	15.0	79	561,136	507,403	11.0

of intake was originally 100, which in the new plant was made 96, thus showing that my contention is correct. I would further ask whether the saving in cost made possible by the decreased length, assuming there is no greater width required, is not more than eaten up in cost of this special draft tube.

Mr. Ayers gives the efficiencies of the Nagler wheel as 85 per cent and 86.7 per cent, saying they are only about 2½ per cent lower than the best standard-type runners. This is not in accordance with recorded facts, for there are many official tests of standard wheels, and one especially, the "Leffel runner test (Holyoke), No. 2,359," which gave as high as 93.07 per cent. This is 6.37 per cent higher than any test he shows for the Nagler wheel.

Mr. Ayres states further than this deficiency in the Nagler wheel is compensated for by the increased efficiency in the generator due to the higher speed of the Nagler wheel. Again this is incorrect, for there could not be that much difference in generator efficiencies for the difference in the speeds possible. I make this claim

EFFICIENCY (IN PERCENTAGE) OF 500-KVA. ALTERNATORS, THREE-PHASE, 60 CYCLES, 2,300 VOLTS

Load	200 R.p.m.	150 R.p.m.	138 R.p.m.
Full	91.6	90.7	90.6
Three-quarters	91.4	90.5	90.5
One-half	90.1	89.7	89.7

on the basis of guaranteed certified tests from one of the big electrical firms for a project I am now handling where the sizes are almost duplicates of those he discusses. I show in the accompanying table the efficiencies obtained.

There is, therefore, according to Mr. Ayres' statements, a loss of 2½ per cent between the Nagler wheel and a standard modern make of wheel. The generator efficiencies of my table show only 1 per cent maximum loss, leaving the Nagler wheel still a loser of efficiency by 1½ per cent.

I would finally ask Mr. Ayres if it is not a fact that all engineers and most buyers are capitalizing on high efficiencies, and if this be true, why the standard makes of wheels are not a better purchase.

The James Leffel & Company, H. H. WHITE,
Atlanta, Ga. District Engineer.

Safety Code Administration

To the Editor of the ELECTRICAL WORLD:

SIR: In answer to inquiries addressed to me for further information in connection with my statement regarding California's Electrical Safety Code, as published in the ELECTRICAL WORLD for Dec. 25, 1920, page 1275, the following is submitted:

Many theories have been advanced from time to time concerning the practicability of administering codes for the prevention of fires and accidents arising in both cases from electrical causes by the same administrative authority. A fire code is designed to reduce property loss directly traceable to fires of electrical origin by incorporating certain specific requirements dealing with electrical materials and installation methods adherence to which should reduce that possibility to a minimum. The California "Electrical Utilization Safety Orders," on the other hand, have for their object reduction of electrical accidents from shock, flash, burn or otherwise. Both of these codes have a distinct value, the extent of this benefit to the people depending largely upon the reasonableness of the rules, the amount of intelligence used in their enforcement and the degree of compliance.

In order that the rules themselves should be just and reasonable, they should be drawn by those who will afterward be called upon to obey them. That they should be intelligently enforced required the services of competent inspectors and the adoption of a plan of rigid inspection, together with an impartial report system by the inspection department. The chief requisites of an efficient inspector are a clear understanding of the rules he is called upon to administer and a marked familiarity with modern electrical devices and practices, together with a knowledge of industrial and commercial applications of electricity.

A close study forces the conclusion that it is difficult indeed to draw a hard and fast line distinguishing between a fire hazard on the one hand and an accident hazard on the other as a given defect may under certain circumstances conduce to either one or even to both. The enforcement of an electrical fire code, therefore, does not call for specialized training of inspectors, and our experience in actual practice has been that a qualified inspector is able to handle both fire and accident inspection work.

The need of uniformity of regulations in the installation of electrical equipment and devices is very real. In California there are at present about thirty-eight municipal ordinances, each differing more or less widely, and therefore no small amount of dissatisfaction and confusion is caused. Our contention has always been that under the same conditions of equipment and construction a hazard would be just the same regardless of the geographical location, and for that reason a requirement inside or outside of fixed fire limits should be the same in Los Angeles, for example, as in San Francisco or any other city of the first class, and the same should hold true for other municipalities of a given classification.

The hope then, of uniformity lies in a state-wide code for prevention of both fire and accidents arising from electrical causes. In the event that this single code combines all the essential requirements of the National Electrical Code and other rules for fire prevention equally valuable, together with reasonable rules formulated for accident prevention, will not the interests of the people be conserved and will not the principal object sought be fully realized?

After three years' experience in administering the provisions of the National Electrical Code, as published by the National Fire Protection Association, and the "Electrical Utilization Safety Orders" of our California Industrial Accident Commission, we are convinced of the practicability of and the necessity for a complete electrical code. Tentative copies of this enlarged code may be available about the early part of March.

ROBERT L. ELTRINGHAM,
Electrical Engineer.

California Industrial Accident Commission,
San Francisco, Cal.

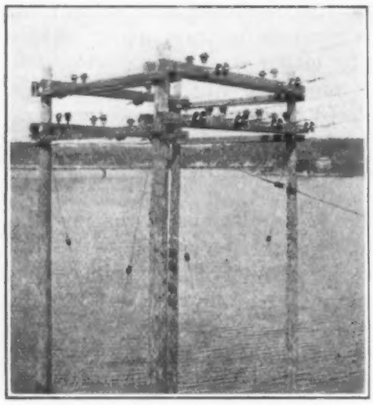
REWARD *as an incentive is closely allied to pain. It spells security for one's self and family. It is one of the things which must be attended to if effective action is to be maintained. There is also a definite relation between reward and the instinct to achieve, but concentration upon the thought of the reward short-circuits the whole creative process.*—CHARLES P. STEINMETZ.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Four-Pole Rack for River Span

A FOUR-POLE rack with concrete base supports the 500-ft. span across the St. Joseph River at Berrien Springs, Mich. The rack, which was built by the Indiana & Michigan Electric Company, has four poles 55 ft. long and set in concrete to a depth of approximately 7½ ft. The poles are 12 ft. apart and the cross-members are sixteen 6-in. x 12-ft. timbers.



FOUR-POLE TOWER SUPPORTING SIX NO. 2/0 CONDUCTORS ON 500-FT. SPAN

There are two circuits (six conductors) of No. 2/0 solid bare copper leading to the rack and No. 2/0 stranded bare copper strung across the river. The lines are on two suspension insulators with a hole bored through the arm and an eye bolt and ½-in. messenger leading across to the opposite insulators. The conductors are carried over the cross-members on pin-type insulators.

R. F. MUNDORFF.
Kansas City, Mo.

Instructions for Inspecting and Cleaning Boilers

BOILERS should be carefully inspected and systematically cleaned. When a boiler is to be taken off the line for washing stop delivering coal to the boiler furnaces. Burn out the fire in the furnace as soon as possible, and when the fire is out close the damper. Shut off the boiler stop valves and notice if the automatic valve is holding. Blow all water out of the boiler when the steam is down to about 15 lb. or 20 lb. per square inch. Blow off all soot from tubes and superheaters and wash down with water spray.

For the purpose of inspection take off all hand-hole plates on the front header and manhole plates on the back of the steam drums. Look carefully for leaky hand-hole plates on the back header, and if any are found remove them and replace the gaskets. Inspect the tubes inside the furnace for bags and blisters. Cut out defective tubes and replace with new ones. Inspect all tubes internally for mud and scale. After the workmen have finished cleaning, inspect the steam drums and water columns. If scale or mud is found, wash and scrape clean.

Inspect the superheaters and their connections to the steam drums. After the scale is removed from the steam drums, inspect the rivets and seams for corrosion, pitting or grooving of the steam-drum plates. Inspect the furnace and clean the side walls, back walls, arches and water-back. If any defective bricks are found, have them repaired or renewed. Inspect the stoker and grate and repair any parts that may be found defective. See that the steam gage is registering correctly.

When filling a boiler with water preparatory to putting it back in service, notice any leaks that develop and mark them. If a leak cannot be stopped while the water is in the boiler, draw the water off, repair the leaks and refill the boiler. If the boiler is found tight, start the fire, but do not crowd the boiler too hard at first. A cold boiler should not be fired up to 200 lb. of steam in less than two and one-half to three hours. After the steam is up to 100 lb. or 150 lb. blow out the superheater. When the pressure is within 5 lb. of the other boilers on the line, open the header valve very slowly and let the boiler carry its share of the load.

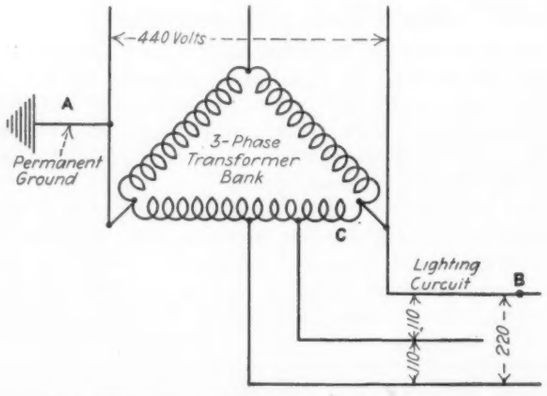
Iowa Railway & Light Company, Marshalltown, Iowa.

JOHN M. MAY,
Traveling Engineer.

Method of Grounding Deserves Serious Consideration

SINCE improper grounding of a distribution circuit, as shown in the accompanying diagram, recently caused the death of a man who accidentally came in contact with the wire marked *B*, it is advisable to avoid any practice which will establish the conditions which led to this fatality. The drawing shows an arrangement resorted to for securing lighting service for 440-volt transformers.

It is sometimes not advisable to ground any point of a secondary circuit if the voltage between any other point and ground will be dangerous. If a circuit is



GROUNDING ARRANGEMENT THAT IS DANGEROUS

not grounded, it should be mounted where it cannot be reached—at least 8 ft. above the floor—or protected by barriers. General practice seems to place the limit for grounded circuits at 150 volts to ground, which

means that 300-volt, three-wire circuits are the highest that should be grounded. This would bar grounding on 220-volt, three-phase circuits or any other circuit of this type. On some three-phase, 220-volt delta-connected transformer banks one transformer neutral is often run out to serve three-wire lighting circuits. When this neutral is grounded it should be remembered that approximately 190 volts can be secured between the third 220-volt wire and the neutral. Shifting of transformers from one combination to another to secure desired results is so easy that the effect of a neutral ground is often overlooked.

Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

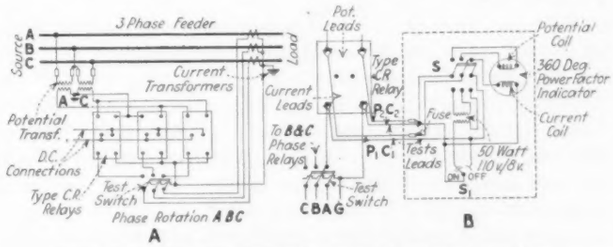
Improvised Forced Lubrication Prevents Blower Breakdowns

BY APPLYING forced lubrication to draft fans repeated burning out of bearings was stopped in one of the stations of the Philadelphia (Pa.) Electric Company. In this station serious loss of blower capacity due to the burning out of bearings on turbine-driven fans was formerly a frequent occurrence. These bearings are ring-oiled, and the rings would not carry sufficient oil. After a considerable amount of experimenting with various oils and different schemes for getting the rings to carry more oil, the trouble was practically eliminated by running a pipe to the bearing from the oil pump provided for forced circulation to the turbine reduction gear. Through this pipe a positive and greatly increased flow of oil to the bearing was obtained. This has resulted in eliminating the trouble and the bearings now have a normal life.

Philadelphia (Pa.) Electric Co. F. C. RALSTON, Operating Division.

Testing Reverse-Power Relays Without Removing Leads

FOR readily testing Westinghouse type "CR" reverse-power (directional) relays to make sure that all connections, etc., are correct the device described in the following paragraphs was developed by the Philadelphia Electric Company. All equipment is compactly mounted in one box and no relay connections are removed while making the test. These relays must be connected so that the current in each relay leads the

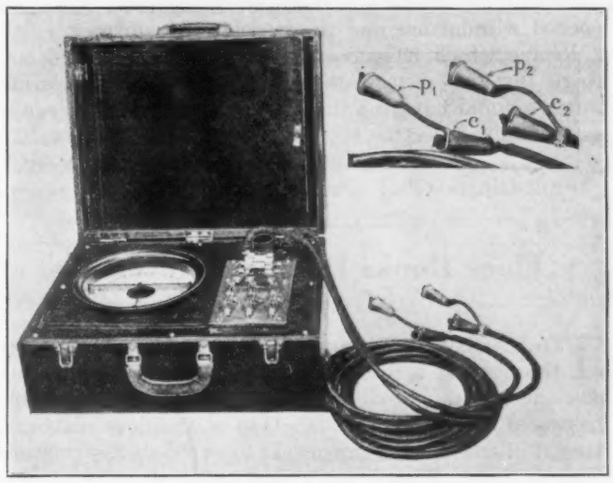


CONNECTIONS FOR TESTING REVERSE-POWER RELAYS, WESTINGHOUSE TYPE CR

A—Westinghouse type CR reverse-power relays connected to a three-phase feeder. B—Internal connections of test device and connections of test leads to relay terminals.

voltage by 30 deg. at unity power factor. The testing device, in addition to checking the 30-deg. angle of lead, checks the operation of the wattmeter element of the relay to make sure that its contacts close on reverse direction of power. Furthermore, the test is made without disconnecting any wires in the relay circuit which might result in their being reconnected incorrectly. The adjustment of the excess current element of the relay for operating current and time is made before the test outlined.

The testing device consists essentially of a 360-deg. power-factor indicator and a small transformer connected as shown at *B*. The leads P_1, P_2, C_1 and C_2 of the test set are arranged in pairs as shown in the



OUTFIT FOR TESTING REVERSE-POWER RELAYS IN CONVENIENT CARRYING CASE

The inserted view shows how the leads are constructed to prevent improper connection to the relay.

illustration, so that it is almost impossible to connect them to the relay terminals in an improper manner.

To determine if the connections give a lead of 30 deg. at unity power factor the leads are connected as shown to the potential *(p)* and the current *(c)* terminals of the relay. The feeder on which the relay is installed should carry not less than one-quarter of rated current in the normal direction. The relay test switch is closed, switch *S* is closed in the upper position and switch S_1 is turned to the "on" position, after which the current circuit in the relay is opened by turning out the screw used to make the adjustment for minimum operating current. The pointer of the power-factor indicator will take a position depending upon the calibration of the test device. The power factor of the load carried by the feeder must be taken into consideration when observing the instrument pointer in order to determine the correctness of the relay connections. Therefore the dial of the power-factor indicator is marked so that when its indication corresponds to the feeder power factor it is known that the connections to the relay are correct.

In testing the operation of the reverse-power element the feeder should be alive, but if it is carrying load the direct-current circuit to the trip coils should be opened. The test is made by opening the relay test switch, closing switch *S* in the down position, and turning switch S_1 to the "on" position. Then the 50-watt, 110/8-volt transformer excited from the feeder potential transformer sends current through the current coil of the relay. If the relay is in good shape the contact of the element under test will close. If desired, the transformer might be so connected that on making these connections the contacts would open, but in the device as made the contacts close when the relay wiring is correct.

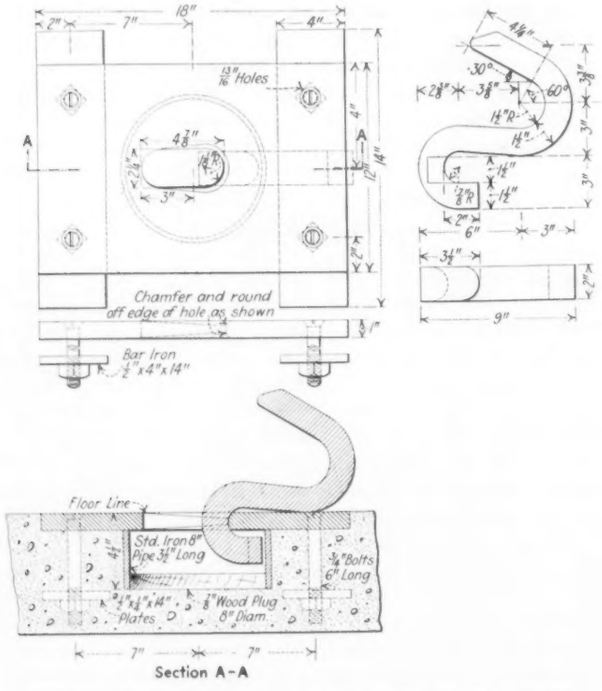
The equipment comprising the test device is mounted in a convenient carrying case. The flexible leads used for connecting to the relay under test are permanently connected to the test equipment to prevent the possibility of their being connected incorrectly for any test. There is room for the leads in the hinged cover of the case. Switch S_1 is not necessary, but is sometimes useful. When in the "off" position it short circuits the current terminals of the relay, so that Switch S may be opened without opening the current transformer.

Relays which have been shown to be connected correctly by the tests outlined should also be carefully inspected and have the time settings accurately made so as to obtain selective action.

RAYMOND BAILEY,
Assistant Chief Electrical Designer.
Philadelphia (Pa.) Electric Company.

Floor Hooks Facilitate Movement of Apparatus

TO FACILITATE moving heavy equipment about the floor of a recently built substation in St. Louis steel hooks are inserted in special floor plates and rope is passed around the hooks. One of the floor plates, as shown in the detail drawing, is inserted in the concrete floor in front of each vault containing transformers or other heavy apparatus, and the hooks are kept on hand in convenient places. The possible routes of each piece of apparatus that might have to be moved have been carefully considered, and floor plates have been inserted at every turn or point where they may be of assistance



DETAILS OF HOOK AND FLOOR PLATE USED TO HELP MOVE SUBSTATION APPARATUS

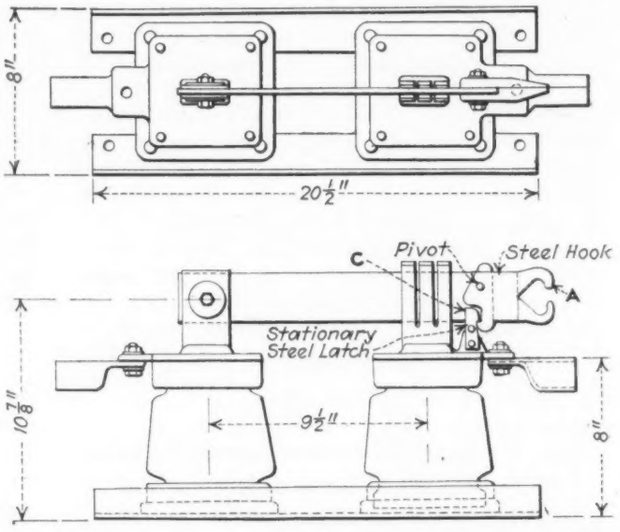
in an emergency. The same scheme is used for moving a transfer car which runs on a track in front of the transformers for the purpose of shifting in a spare transformer for one that is being taken out of service for repair or overhauling.

The hook and floor plate shown in the illustration are designed to withstand a pull of about 20,000 lb. The hook is made from a piece of 1.5-in. x 2-in. x 20-in. bar iron. The material in one pull box consists of one steel plate 1 in. x 12 in. x 18 in., two pieces of 0.5-in. x 4-in. x 1.25-in. bar iron, four 0.75-in. x 6-in. flat-head machine screws and nuts, one piece of 8-in. standard iron pipe 3.5 in. long, and one wooden plug 8 in. in diameter by 0.875 in. thick.

WALTER H. MILLAN,
Superintendent of Substations.
Union Electric Light & Power Company,
St. Louis, Mo.

Disconnecting Switch Opened Without Strain on Supports

AN 11,000-VOLT disconnecting switch which cannot be opened unintentionally but is easily opened by an operator has been developed for the Springdale plant of the West Penn Power Company, Pittsburgh,



LOCKING DISCONNECTING SWITCH WHICH IS OPENED WITHOUT STRAIN ON SUPPORTS

Pa. A lever action starts the switch to open without the use of much force. This switch has a steel hook pivoted to the end of the blade, and when closed the hook engages with a steel latch on the stationary insulator cap.

To open the switch the operator pulls on the hook at point A, which unlatches the switch, the lug on the hook casting pushing against the top of the stationary steel latch at C, which moves the switch blade in its contacts about $\frac{1}{4}$ in., thus breaking the set and making it very easy to pull the blade the rest of the way out of the contacts. If this lug were not provided to pry the blade loose by acting on the stationary steel latch, the operator would have to pull quite hard on the blade, which would put a heavy stress on the supporting insulator and might break it, in addition to causing a possible troublesome delay in getting the blade to start. The lever action provided does not put any excess strain on the insulator, and as the operator pulls on a lever considerably longer than the one which loosens the blade, it is quite easy for him to get the switch to start.

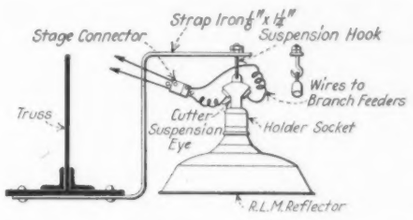
GEORGE S. HUMPHREY,
West Penn Power Company, Electrical Engineer.
Pittsburgh, Pa.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Mounting a Lighting Reflector Out of the Way of Cranes

IN ORDER to avoid a traveling crane, the lighting unit shown in the accompanying drawing was mounted on a piece of strap iron so that the bottom of the reflector came just level with the ceiling truss. In this position the reflector will not be struck by the crane as it travels, but at the same time it will be accessible from the crane. For a support a piece of ⅜-in. x 1¼-in. (3.2-mm. x 32-mm.) strap iron, bent in two right angles, is fastened to the lower edge of the steel beam. The unit is hung on a suspension hook passing through the outer end of the strap-iron support by means of a Cutter suspension eye, No. 30,196. An R. L. M. reflector is employed to throw the light downward. The connection is made to the branch feeder through a stage connector. This allows the entire unit to be disconnected and removed to a safer place for cleaning. When the unit is disconnected it is replaced immediately with a clean unit so that it is not necessary to bring back the original unit after it is cleaned.



MOUNTING FOR LIGHT UNIT WHERE THERE IS INSUFFICIENT CLEARANCE UNDER THE TRUSSES

SAMUEL G. HIBBEN,
Consulting Illuminating Engineer.
Westinghouse Lamp Company,
Bloomfield, N. J.

Correct Filing of Motor Inspection Records

MAINTENANCE and inspection records are valuable only when intelligently filed and analyzed. After a maintenance department has located and remedied trouble a report should be filed under a head which refers to the machine or service. It is also usually filed under the motor number, but for purposes of analysis it is useless to keep a record of the breakdowns of a certain motor, as this machine might after repair be installed in some other location. The classification heads should be something like these: (1) Hot-metal crane; (2) main hoist controller; (3) yard crane; (4) cross-trolley motor.

Under these heads should be filed the inspectors' reports, with date of breakdowns, cost of repairs and reason for failure. Such a record is not expensive to keep up and is not a useless luxury but a stern necessity.

An immediate result is to direct attention to any location where trouble is more frequent than it should be. Perhaps the motor at this place is not big enough, is not properly connected to its work, is badly handled, or there is some other reason for the frequent failures, but the reason will not be discovered unless the fact is known that the machines used for that particular job give too much trouble.

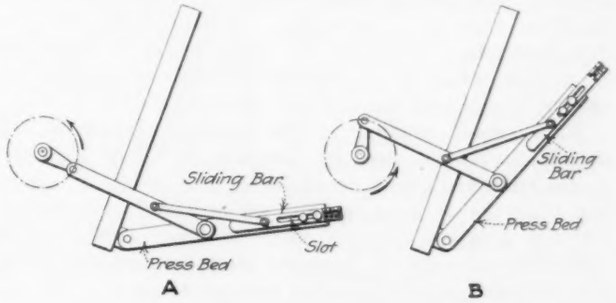
A maintenance record is useful in deciding the number and kind of repair parts that must be kept on hand and in keeping watch on the quality of the work turned out by the repair shop. Finally, such a record to be of any value must be consulted and its evidence weighed from time to time. Too often careful records are kept and never used to better conditions.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Device to Prevent Operators' Hands Being Caught in Presses

A HOME-MADE device used for some years by the writer for preventing presses from closing on the hands of operators was brought to mind by the description of the method of controlling toggle presses in the ELECTRICAL WORLD for Nov. 13, page 681. The device designed by the writer consisted of a rod across the front of the press which the operator's hand would strike, thus opening a switch which stopped the motor. In the accompanying drawing the principle of its operation is shown as applied to a job printing press. With suitable modifications it can be used on any other type of press.

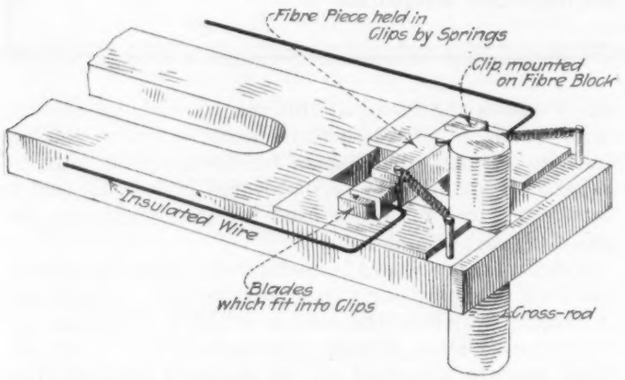
Details of the circuit-breaking switch are shown on the following page. This switch consists of two small bronze clips mounted on fiber strips on each side of a slot cut in an iron bar. Two bronze blades mounted on a fiber block are normally held in these clips by two springs fastened to the fiber block and to the ends of the bar. A cross rod extending across the front end of the press fits in the slots in the bars on each side of the press. Pressure on this rod forces the blades out of the contact clips, thus breaking an electrical circuit. This breaking of the electrical circuit serves to operate



IF OPERATOR PUTS HAND INSIDE PRESS WHEN IT IS CLOSING MOTOR CIRCUIT WILL BE OPENED

the no-voltage release on the motor switch, and if necessary, a brake may be connected to operate when this circuit is open.

With some types of presses this bar might be mounted securely on the side of the moving bed of the press. In this case the cross rod would stick out considerably



SPRING CONTACT PLACED ON EDGE OF PRESS TO OPEN CIRCUIT IF OPERATOR'S HAND IS CAUGHT

beyond the end of the press bed. In the mounting used on the job presses, however, it was objectionable to have the cross rod sticking out any considerable distance beyond the end of the press bed and, therefore, the bar was slotted and mounted so that it would slide on the side of the bed as shown at *A* and *B*. With this arrangement, when the press is open, the cross rod is drawn down close to the edge of the plate. When the press starts to close, however, as shown at *B*, the bar is raised so that it projects some distance beyond the end of the bed, and the rod will be sure to strike the operator's hand if it is left in the space between the two plates.

W. A. HARRIS.

New York, N. Y.

Accurate Electromagnetic Control in Heat Treatment of Steel

IN THE preparation of high-carbon steel for cutting tools it is often desirable to heat the metal to a temperature just above the point of loss of magnetic susceptibility before quenching. If heated much above this point, the metal is apt to become brittle. This change in magnetic susceptibility of steel affords an excellent method of controlling the temperature of electric furnaces. The point at which magnetic susceptibility falls away can be readily detected by means of an exploring coil over the furnace chamber.

In a recent number of the London *Electrician* an article on this subject by Lancelot W. Wild appears. It describes the use of an exploring-coil secondary winding over the furnace, within which is an alternating-current primary heating coil. Another and separate transformer, with its primary winding in the heating circuit, enables a differential balance to be kept on the furnace in such a manner that a galvanometer in the secondary circuit shows no current when the furnace charge becomes non-magnetic.

It might be supposed that this magnetic detector of non-magnetic temperature could only be applied to alternating-current furnaces, but the article shows that a modification of the method is also applicable to direct-current furnaces. FIELD EDITOR ELECTRICAL WORLD.

New York, N. Y.

Repairing a Grounded and Poorly Soldered Armature

A GROUNDED and poorly soldered commutator was recently sent to an Eastern shop to have the trouble determined and remedied. The armature had partly closed slots. After locating the coil in which the ground occurred the leads of the grounded coil were removed from the commutator and the top lead was lifted out of the slot. The ground was found at the rear end of the slot. At this point the wire was taped with thin silk tape and laid back in the slot in a new trough of 0.010-in. varnished cloth. Thin air-drying paint was put in the slot and a slot stick inserted while the paint was soft.

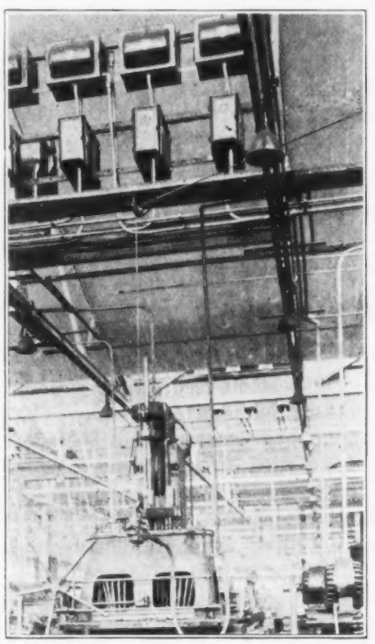
After reconnecting, however, a voltmeter test from bar to bar of the commutator showed a very uneven reading, a number of readings being quite high. The leads at which the readings were high were removed for inspection, which showed the bottom leads to be quite short and not soldered to the commutator. To correct this condition all of the leads were removed from the commutator and cleaned. They were then replaced and soldered with soft solder and a rosin flux. On the second voltmeter test a uniform reading was obtained, indicating freedom from short circuit and loose connections.

A. HERVEY.

New York, N. Y.

Automatic Switches Mounted Overhead

TO SAVE working space the automatic control apparatus of a number of machines is mounted between the roof trusses in the shops of the Canadian Products Division of the General Motors Company. In the accompanying photograph the four sets of control devices shown in the upper foreground consist of standard inclosed externally operated switches, shown above, and iron boxes, lower down, containing relays for stopping and starting 3-hp. motors. A push-button station, for starting and stopping the machine in the foreground, is mounted on the front of the machine, and the automatic compensator which this push-button operates can be seen to the left and somewhat to the rear of the front line of automatic-control devices overhead. The machine is a National Automatic Tool Company's No. 30 multiple-spindle drill driven by a 15-hp., 1,500-r.p.m. squirrel-cage motor mounted on the rear of the machine.



WORKING SPACE SAVED BY MOUNTING AUTOMATIC SWITCHES OVERHEAD

Canadian Products Division
of General Motors Co.,
Walkerville, Ont.

ALEX. H. MAY,
Works Engineer.

Motor Selection for Oil-Well Pumping

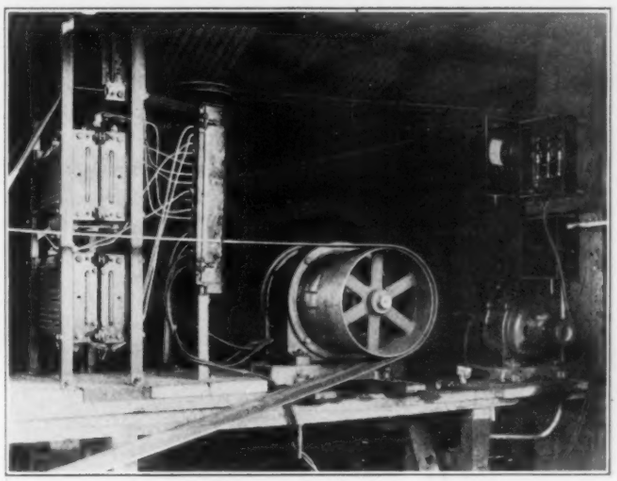
SO MANY factors affect the amount of power required to pump a well that the most careful calculations will not check with the results of actual tests. A large amount of sand will considerably increase the power required, while the presence of gas will act as a lifting agent and considerably decrease the power input. Furthermore, proper counterbalancing to offset the weight of the rods operates to effect a considerable saving in power. Other conditions being equal, the power required to pump a well will depend on the length of stroke, the number of strokes per minute and the size of tubing.

Motors for pumping, pulling and cleaning, although of the same general type as those employed for drilling, are of considerably smaller horsepower. Wells can be pumped electrically by any one of three methods —from a power jack—by a small motor suitable for pumping duty only, or by a special motor designed to take care of all of the necessary operations around a pumping well.

In shallow territories, where the wells are small producers, where pulling and cleaning have to be done very infrequently, and where the location of the different wells makes such a method practicable, a number of wells can be operated from a central power head or jack at a comparatively low cost per well. A standard constant-speed, squirrel-cage induction motor is suitable for practically all conditions. The motor is belted to a countershaft, which is in turn belted to the power head through a quarter-turn belt. The power required for pumping wells by this method depends upon how well they are balanced against one another.

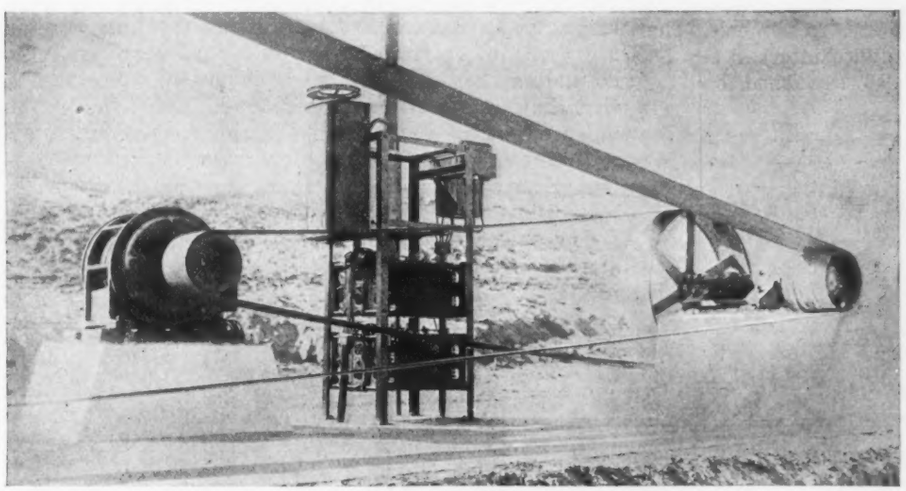
Wells on the beam which have settled down so that a given constant speed of pumping is satisfactory, but which by reason of their production cannot be satisfactorily operated from a power jack, can be individually operated by small-horsepower, squirrel-cage induction motors. Should it be advisable to vary the speed of the well from time to time, a single variable-speed motor can be employed instead of a constant-speed squirrel-cage motor. In either of the last two mentioned applications some external means must be employed for the shaking up and pulling or cleaning operations.

On the majority of wells pumped by individual motors it is preferable that all operations of pumping, cleaning and pulling shall be performed by one motor, just as with steam-engine drive. To meet the wide range of duty thus imposed motor equipments of double rating have been designed. They are of the two-speed, variable-speed type, and by means of a pole-changing switch on the motor frame the capacity and speed of the motor can be instantly changed from, for example, 15 hp. at 600 r.p.m. to a normal rating of 30 hp. at 1,200 r.p.m. Nothing is necessary to effect this change except throwing the pole-changing switch. This method appeals to the operator on account of its simplicity and flexibility. Three standard equipments have been developed with ratings of 10/25 hp., 15/30 hp. and 20/50 hp. with corresponding speeds of 600/1,200 r.p.m. at 60 cycles. The motor is designed with a six-phase rotor and a stator winding capable of being connected either six poles or twelve poles at the option of the operator. The object of this design was to provide a motor of small horsepower, low speed and good efficiency for pumping operations and at the same time make provision for the necessary capacity at a higher speed for pulling and cleaning. The pole-changing switch doubles both the capacity and speed of the motor for this latter duty. Regardless of the size of the motor, an equipment consists of the motor with its base and pulley, a controller operated by a telegraph cord from the headache post, a speed-regulating resistor, and an oil circuit breaker for protection against under-voltage and excessive overload. A



RECENT IMPROVEMENTS IN MOTOR DRIVE HAVE TENDED TO ELIMINATE THIS TYPE OF INSTALLATION

The small squirrel-cage type motor is used for pumping on the beam, while the larger slip-ring motor is used for pulling and cleaning.



AN INSTALLATION USING A DOUBLE-RATED 15/30-HP. PUMPING, PULLING AND CLEANING MOTOR

speed-reducing countershaft is also necessary, and in instances where the motor equipment is to replace a worn-out steam or gas engine the crankshaft of the engine is often used as a countershaft after replacing the heavy flywheels with pulleys of proper size.

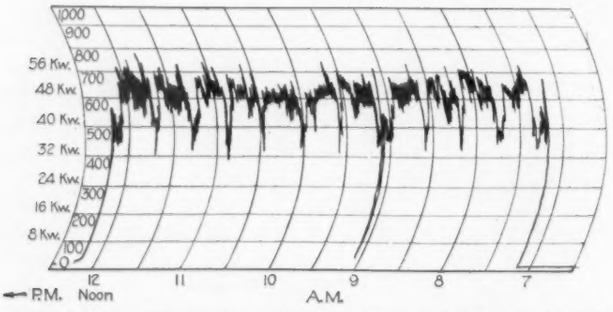
Although there are some wells which could be satisfactorily handled by the pumping motor rated at 10/25 hp., the conservative tendency of the oil operators to provide more power than necessary rather than "take a chance" has resulted in the 15/30-hp. equipment being accepted as the standard. It is only in cases of wells of exceptional depth or of very heavy gravity and with oversize tubing that the motor rated 25/50 hp. has been used.

On the basis of present prices, a 15/30-hp. equipment can be installed complete, ready to run, inclusive of countershaft with the proper size of pulleys, but exclusive of belts, buildings or foundations, for approximately $2,000. The same installation using a 20/50-hp. equipment would cost approximately $2,500.

General Electric Company, W. G. LANE,
Los Angeles, Cal. Engineer.

Cotton Gin Shows Energy Consumption of 16.5 Kw.-Hr. per Bale

THE load characteristics of a typical cotton gin are brought out in the accompanying graphic meter record of a forenoon's operation of a ginnery connected to the lines of the Georgia Railway & Power Company. The chart has been furnished to the ELECTRICAL WORLD by Charles A. Collier of that company. The ginnery whose operation is recorded has four stands, each gin having seventy 10-in. (25-cm.) saws. The tramper is operated by compressed air. A 50-hp., squirrel-cage-type, 2,200-volt motor, operating at 900 r.p.m., is installed. During the particular day shown the ginnery was in operation nine hours and fifty-five minutes, in which time thirty-four bales were ginned, an average of seventeen and one-half minutes per bale. The energy consumed was 462 kw.-hr., or 13.5 kw.-hr. per bale. The maximum demand for a thirty-minute interval was 53 kw. The accompanying table, also furnished by Mr.



TYPICAL LOAD CURVE FOR A FOUR-STAND SEVENTY-SAW COTTON GIN DRIVEN BY A 50-HP. MOTOR

Collier, was obtained by taking the average of twelve cotton-gin installations.

As the cotton leaves the farm it consists of a mass of seeds with the attached fibers, mixed with impurities such as dirt, trash and fragments of bolls. The first step in its manufacture is necessarily the separation of the cotton fibers from the seeds, the well-known process of ginning. This separation is accomplished by the cotton gin, and the plant at which gins are installed is termed a ginnery. It is in this process that mechanical energy is first required in the treatment of the cotton.

A standard modern cotton gin consists of an elevator operated by an exhaust fan for removing the cotton from the wagon or storehouse and conveying it to the feeders; several sets of feeders and gins; a flue through which the lint cotton is conveyed to the condensers, by which it is formed into a bat, and a press for forming the cotton into bales and wrapping it for shipment. All of these operations may be regarded as auxiliary to the principal process of ginning, and the size and number of gins determine the capacity of the plant. A cotton gin consists essentially of a series of circular saws from 10 in. to 14 in. (25 cm. to 35 cm.) in diameter, mounted side by side on a shaft. The teeth of the saws project through a grid into a hopper, and their rapid rotation collects the cotton fibers on the teeth, drawing it through the grid and leaving the seeds behind. The separated fibers, called lint cotton, are removed from the saw either by a rapidly revolving brush or by an air blast. A standard gin has seventy or eighty saws, and most plants have four gins, although there are many two-gin or three-gin outfits in operation.

AVERAGE REQUIREMENTS FOR TWELVE INSTALLATIONS

Number of stands per gin	4
Number of saws per stand	71
Size of saws in inches	10.5
Saws per horsepower of motor capacity	4.77
Horsepower of motor	60
Number of bales ginned per season	1,271
Energy consumption per season, kw.-hr.	19,733
Kw.-hr. per bale	16.51

Auxiliary to each gin are feeders, which clean and prepare the cotton or ginning and supply it uniformly to the machines. The feeders are usually driven by pulleys and belts from the line shaft. The conveyors both to and from the gins are operated either by belt conveyors or, preferably, by fans. The baling of the cotton requires a powerful press, either screw or hydraulically operated. A gin of the standard type has a capacity of from 60 lb. to 150 lb. of cotton per hour, depending on the condition of the cotton, which means that the ginning of a standard 500-lb. bale requires for a four-standard ginnery from fifteen to thirty minutes.

A cotton ginnery may be operated as well by electricity as by mechanical power, since no heat energy is used in the process.

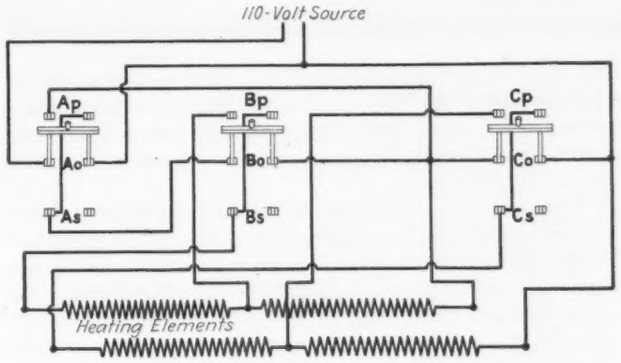
The power requirement of each type of machine in a standard gin is approximately as given in the following table:

	Hp.
Conveyor	2.0
Cotton cleaner (if used)	5.0
Four seventy-saw feeders	3.0
Four seventy-saw gins	25.0
Fans	25.0
40-in. condenser	1.0
Tramper	4.0
Press	15.0
Total	80.0

However, there is a certain amount of diversity in the demand of this equipment which makes the total power requirement somewhat less than that indicated, and a 75-hp. motor is generally considered ample for a four-stand ginnery.

Wide Variations of Resistance Obtained with Three Switches

IN ORDER to change the current of an electric oven over wide ranges it was connected up to three double-pole switches as shown in the accompanying drawing. With this connection six different current values may be



ARRANGEMENT OF SWITCHES AND RESISTORS WHICH GIVES WIDE RANGE OF CURRENT

secured, ranging from 3.75 amp. to 60 amp. The accompanying table shows in what direction the switches must be thrown for the different values of current.

This combination of switches was employed to vary

Position of Switches	Total Amp.	Position of Switches	Total Amp.
As—Bs—Cs	3.75	Ap—Bp—Co	30
As—Bp—Cs	6	Ap—Bp—Cs	37.5
Ap—Bs—Co	7.5	Ap—Bp—Cp	60
As—Bp—Cp	15		

the temperature of a baking oven installed in Lima, Peru.

As the heating elements were quite small and closely spaced, the suppression of every other element in some of the switch combinations did not materially alter the uniformity of the heat distribution.

Lima, Peru. VICTOR M. ARANA,
Consulting Electrical Engineer.

Speed Variation of Slip-Ring Motor Due to Faulty Secondary Fuse

WIDE variation in speed of a slip-ring motor in a large pipe mill was found after some investigation to be due to a defective fuse in the secondary leads. The motor was a three-phase motor of the slip-ring type with a drum controller and grid resistors. The circuit leading from the slip rings was carried through conduit to the controller and resistors. Near the motor the circuit passed through a three-pole fuse extension switch so that the starting equipment could be entirely disconnected from the motor. It was suggested that an open circuit in one phase of the secondary circuit might cause the peculiar action of the motor. However, a test of the circuit with a magneto disclosed no sign of trouble.

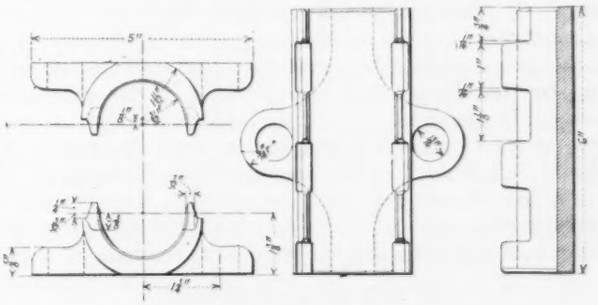
It was then decided to examine the circuit piece by piece, but nothing was found until the three-pole switch in the secondary controller circuit was examined. Here it was discovered that one of the link fuses had become unsoldered from the terminal clip, but when the motor was not operating it still made contact. For this reason the magneto did not reveal the trouble. When the machine was in operation the vibration occasionally caused the contact to be broken, resulting in variations in the motor speed. HARRY RUSH,
Assistant Professor of Mechanical Engineering.
North Dakota Agricultural College,
Fargo, N. D.

Selection and Installation of Mine Cables

WHEN ordering three-conductor cables to carry 2,200-volt, three-phase service down mine shafts one of the large companies in the Lake Superior iron-mining district specifies that each conductor be insulated with approximately $\frac{5}{32}$-in. (4-mm.) 30 per cent Para rubber compound and that the conductors be laid up with saturated jute fillers, taped with jute and armored with galvanized steel wires of sufficient number and size to support the entire length of cable when hung in shaft from one end. The cables are ordered in one piece, and those now in use on the company's properties include such lengths as 1,520 ft. (456 m.) of 300,000-circ.mil (151.8-sq.mm.) and 2,800 ft. (840 m.) of No. 2/0 (57.5-sq.mm.) cables.

It will be noted that lead covering is not included in the specifications. Earlier cables were installed with the lead sheath in addition to the armor, but later practice has been to build these cables with a heavier serving of saturated jute and without the lead casing. This gives a cable which is less expensive to build, of lighter weight and easier to handle because of its greater flexibility.

In the ELECTRICAL WORLD of June 5, 1920, a method was described of installing cables in mine shafts by first lowering the cable to the bottom of the mine and then hoisting the cable into position by fastening one end to the cage. This cannot be done with the long lengths of cable which have been referred to above because the reels required to hold them are too large to enter the shaft opening. It is therefore the practice of this company to wind the cable from the cable drum onto the hoist drum and then unwind the cable from the hoist drum into the shaft. The cable is then secured in place every 12 ft. to 18 ft. (3.6 m. to 5.4 m.) by the



CABLE CLAMP FOR MINE SHAFTS

The dimensions shown are for a No. 2 gage three-conductor, 5,000-volt, cable wrapped with jute and armored with galvanized-steel wire.

clamps shown in the illustration. In shafts with concrete sets and dividers the clamps are bolted to cast-iron inserts poured in concrete. In shafts with steel dividers and sets, concrete-lined, the steel is drilled to hold the clamps. It will be noticed that the sides of the top and bottom half of the cable clamp intermesh, so that an even pressure can be applied all around cable without squeezing out the rubber insulation.

Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

How Utilities Can Hasten Better Public Relations

SOME very important statements on a utility's public policy were made by E. K. Hall, vice-president of the American Telephone & Telegraph Company, in the course of a recent address before the Indiana Public Utilities Association. Mr. Hall pointed out that public bitterness against profiteers had caused much of the opposition to higher public utility rates, although the utilities were far from being profiteers.

"What is the trouble?" asked Mr. Hall. "The utilities have the knowledge and the information and have been trying to tell their story to the public for some time, but the public does not understand because it does not believe. The utility business is very young, no one had visualized the field very clearly, and through the development of the art mistakes have been made. In the early days some companies were guilty of questionable transactions and got themselves and the honest utilities into bad repute. Since then the utilities have been paying the bills resulting from these mistakes, and when regulation appeared it started with a hostile attitude.

"The public believed that virtually all rates were excessive, and the utilities were not sufficiently forehanded to tell it otherwise in terms that were convincing and which could be understood by the average customer of an electric light and power company.

"It takes a long time to change a lifetime of opinion, and the utilities must patiently, intelligently and tactfully lay their facts before the people during the next five years and then forever keep the information before them. It must be brought home to the public that it has finished its job of 'spanking the utilities.' The punitive era of teaching utilities to be good has passed and few companies find any profit in shady practices today. If there is any utility company which is not now ready to play fair and square with the public, it should be the duty of the honest utilities summarily to bring the erring one into line. If the utilities don't perform this service, the public will, and if the public takes hold it will punish the good with the bad.

An Era of Co-operation

"The second era of making and keeping utility companies strong enough to do their several jobs has arrived. This must be an era of co-operation and better understanding between the companies and the public, and all distrust must be removed. The new attitude of the public toward the public utilities can be seen, and its complete arrival will be hastened by giving the proper consideration and prominence to the fundamentals of the business.

"For instance, the interest of the public and the utility companies is identical, there is no such thing as profit in the ordinary sense of the word in the utility business, and as to rates the only possible danger to the public is that rates may be too low. It can easily be seen when rates are too high, but if they are too low it takes the heart and flesh out of the business and reacts against the public interests.

"The public thinks that the rates for utility service are too high because as individuals they think that they would charge the highest possible rates if they were running the business. A difference of opinion also arises because the public thinks only in terms of today, while utility operators must consider the future. Furthermore, the public has no conception of the magnitude and intricacy of the task involved in providing the service it demands.

Apologizing for Poor Service Is Bad Policy

"All these points and many others should be taken into account by those responsible for a utility's public policy, but no one man in any company can alone accomplish much in trying to inform the public. Every officer and employee must do his part. No help or sympathy is to be obtained by sobbing and apologizing to the public. Such a policy usually breeds suspicion and distrust. The utilities are performing good service and have a real story to tell the public, but every company should make sure it deserves public confidence before attempting to get public support."

Careless Purchasing Lessens Profit on Merchandising

THAT central stations can make a fair profit on the sale of electrical appliances was shown by a recent survey of merchandising conditions in the Southeastern States. It was found, however, that a number of companies had tied up an unnecessarily large amount of capital in excessive stocks because of inaccurate purchasing records and failure to keep careful account of the stock on hand. The margin of profit between the manufacturer's price and the resale price was found in most instances to be sufficient, although some companies have lost a part of their profit through failure to take advantage of all discounts to which they are entitled. This is due partly to purchasing in quantities less than standard-package lots, thus losing an additional 5 or 10 per cent discount.

In view of these conditions the merchandising committee of the Southeastern Section, N. E. L. A., which made the survey, recommended in its report at the annual convention at Miami, Fla., that wherever possible all companies have a purchasing agent and cost accountant whose duties would be to obtain the best discounts, take advantage of cash discounts and keep accurate purchase and inventory records in order that stocks may be kept at proper levels and at the best prices obtainable.

Cost of Selling $9,250,000 of Utility Securities to 16,000 Investors

A CONVINCING message to small investors is presented in the accompanying advertisement, which appeared in the Wisconsin newspapers during the week of Jan. 17 to 22, 1921.

The companies alluded to in the advertisement are the Milwaukee Electric Railway & Light Company, the Wisconsin Gas & Electric Company (main office, Racine, Wis.), and the Union Electric Light & Power Company of St. Louis — frequently referred to as the North American group. The average over-all cost of selling these securities at par—a total of $9,250,000 — in three years and four months ended Dec. 31, 1920, was well under 3 per cent. Four-fifths of this expenditure was for newspaper display advertising space. The remainder was expended for printing, postage and salaries and commissions to salesmen. High state and federal taxes on large incomes during the years indicated restricted the sale of these taxable securities almost wholly to small investors. It was therefore impracticable to employ field salesmen to canvass for buyers. Advertising had to attract nearly all of the purchasers to the companies' counters. In St. Louis during 1920 some seventy Union Electric employees, organized in departmental teams, did excellent work in pulling the third million of that company's 7 per cent preferred across the mark, earned substantial commissions and in several cases disclosed unsuspected sales talent. In each of the main sales offices one or two office salesmen received customers and two or three others followed up inquiries on the outside.

Looking Back on Four Years' Work in Advertising

"SAFE HOME 7 PER CENTS" in Wisconsin and Missouri

During four years past the writer of these advertisements has seen over 16,000 men and women—all small investors—invest $9,250,000 of their savings in securities of the companies he works for, in Wisconsin and Missouri. Hundreds of these buyers have purchased shares of more than one issue; a good many regularly invest their savings in these securities, year after year.

Of that $9,250,000 total, $4,900,000 was money loaned the companies for five-year or ten-year terms, all of it, except $200,000, at 7% interest; one $300,000 issue pays 6½%. The other $4,350,000 was an investment in the 7% preferred stock of two of the companies. The average investment was under $600.

Every dollar of these securities represents a new dollar actually invested in additions to income-producing plant and business, made with State authority and subject to State approval, for the public service. The business of these companies has grown steadily—at times rapidly. It has not always been easy to get new capital as fast as it was needed to meet increase of demand for our services. The old investors are still in the business, nearly all of them. They have thought well enough of it to go with it through the hard plodding of the war years and the years after the war. They know that while this business can't pay big profits, it is surer than most other businesses to pay fair profits regularly and permanently.

But it has been up to the new, small home investors to supply most of the new millions needed to keep the systems growing during these four years. Just past—and they have done it. This kind of home endorsement means a lot to the men and women on this job. We are all glad to see ownership of these properties gradually passing, more each year, into the hands of thousands of home folks, like ourselves. It means, we believe, closer and more friendly co-operation in our task of keeping these services going and growing. It means that each year a larger share of the earnings of the business is distributed here at home—a just reward for the thrift and courage of the men and women who saved money and invested it here.

Right now we are selling 7% participating preferred stock of Wisconsin Gas & Electric Co.—a $500,000 issue, in $100 shares, at par for cash. Each share pays $7 a year in cash dividends—$1.75 every three months. When business gets back to normal, this stock's right to participate with the Company's common stock in surplus dividend earnings should make it pay more than 7% in fairly good years.

SALES OFFICES

Milwaukee: Securities Dept., Public Service Bldg., main entrance on Sycamore St., between Second and Third Sts. Racine, home office of the Company, 366 Sixth St.; Kenosha, Public Service Bldg.; Watertown, 305 Main St.; Burlington, 715 Pine St.; Whitewater, 79 Main St.; Cudahy, 1008 Packard Ave., South Milwaukee, 2111 Tenth Ave. Mail orders filled promptly by registered letter.

WISCONSIN Gas & Electric Co.

AN EFFECTIVE ADVERTISEMENT USED BY NORTH AMERICAN GROUP OF UTILITIES IN WISCONSIN NEWSPAPERS

A par cash market was maintained by the Union Electric Light & Power Company for its $1,000,000 of 7 per cent preferred sold between Nov. 15, 1919, and Nov. 13, 1920, by reselling more than $650,000 of its earlier issues of preferred for small shareholders who needed money. All of these resales were made at par for cash and without charge by the company for its service. This made the total cost of Union Electric's third million 10 per cent, as compared with 1.123 per cent, the cost of selling its first million in 1917, and a trifle over 2 per cent for its second million in 1918. Incidentally, maintaining a par cash market for the stock in this way, the Union Electric 7 per cent preferred has been established as St. Louis' premier savings investment. For example, the 424 shares of the fourth million sold from Jan. 13 to Jan. 22 inclusive—just ten days—were bought by 112 persons, or at the rate of less than four shares to an individual.

During the last nine and one-half months of 1920 the Wisconsin Gas & Electric Company sold $1,000,000 of five-year and ten-year 7 per cent notes and $570,000 of 7 per cent preferred stock at par for cash, at an over-all selling cost of 4½ per cent.

Portland Company Adopts Bimonthly Billing

NOTICE has been sent to the 40,000 residential customers of the Portland (Ore.) Railway, Light & Power Company that, effective Jan. 1, bills for electric service used will be rendered only once in every two months instead of once a month. It is believed that this will be an acceptable plan to a great majority of the customers, as it will cut in half whatever inconvenience may be attached to allowing meter readers to enter premises and to paying these small bills before the delinquent date.

It is expected that there will be an annual saving of $14,000 effected by the reduction of the meter-reading, billing and distributing force. The various steps on the rate will be doubled and a discount of 10 per cent instead of 5 per cent for prompt payment will be allowed.

The Portland Railway, Light & Power Company is the only large company on the Pacific Coast and one of the few large companies in the country to adopt the bimonthly billing system.

Fractional Shares Recommended for Customer Ownership

IN ADDITION to an appreciation of the public utility situation, the American people will have to be educated to habits of thrift, and to encourage thrift securities may have to be issued in smaller denominations, in the opinion of Fred H. Sheel, manager of the security department of the Insull interests in Chicago, who spoke recently before the Illinois State Electrical Association. Something might be learned, according to Mr. Sheel, from the experiences of the most thrifty people in the world, the French who are retailers of securities first and wholesalers only on occasion. French securities are made for the very small investor, who measures the attractiveness of the security by its safety, simplicity and availability. The sale of securities in France is a regular over-the-counter merchandising transaction, and the national habit of investment has been largely developed by the small denominations and ready availability of the securities.

The minimum size of bonds has been reduced from a thousand dollars to fifty dollars, with very gratifying results to those requiring money, and Mr. Sheel said that it would seem as if the utilities could make their financing much easier if fractional shares were issued or the par value of stocks reduced to a very low sum.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Voltage Relations in Direct-Current Machines.—R. E. FERRIS.—With the increasing voltage now being used in direct-current machinery, it is very important to look into the potential difference more carefully than simply to investigate voltage between ground and single coils. The author analyzes voltage conditions in the common types of direct-current winding.—*Electric Journal*, January, 1921.

Short-Circuit Current of Induction Motors and Generators.—R. E. DOHERTY and E. T. WILLIAMSON.—The authors state that there has been a prevalent opinion that a sudden short circuit of an induction generator would not cause a serious initial rise in current such as occurs in synchronous generators. This has led to the proposal to use such machines as a partial solution of the short-circuit problem on alternating-current systems. Theoretical considerations and experimental data given in the paper show that, on the contrary, there is in the induction generator, just as in the synchronous machine, a serious initial rush of current, which is limited only by the leakage reactance of the machine. The only difference is that the transient is shorter in the induction machine and that the current dies down, of course, to zero instead of to the sustained value which occurs in an excited synchronous generator.—*Journal A. I. E. E.*, January, 1921.

Lamps and Lighting

Manufacture of the Edison Incandescent Lamp.—HENRY SCHROEDER.—A detailed description of the mounting and preparation of the bulb, assembly of mount and bulb, exhausting, basing and packing of both vacuum and gas-filled lamps.—*Bulletin L. D. 119, Edison Lamp Works*, October, 1920.

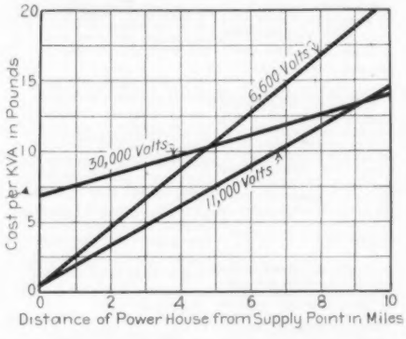
The Gas-Filled Lamp for Stereopticon Service.—H. F. BARNES.—After a review of the conditions which have to be met in this service, some description is given of lamp construction, including an account of how spiral filaments are crowded together for the purpose of producing the high intrinsic brilliancy required.—*Bulletin L. D. 116, Edison Lamp Works*, Harrison, N. J.

Generation, Transmission and Distribution

Central-Station Boiler Practice.—M. K. HABERSHON.—A general treatment of British practice in steam-boiler design for central-station use.—*Beama*, December, 1920.

On the Equilibrium of Suspended Wires.—W. FETTER.—On the basis of a monographic method, earlier described by Seefehlner, the author studies the conditions of equilibrium of a conductor hanging in freely moving suspension insulators, the conductor at certain points being kept rigidly in place by strain insulators. By a special device the equation for one single span is made to apply also to the above-stated case, where the horizontal component of pull will equalize over a number of spans. The author shows by numerical examples that if spans of widely different length are used between two anchoring towers the longitudinal displacements of the wire will cause the actual tension and the actual distance to ground to deviate considerably from the values which would be obtained with fixed suspension points.—*Elektrotechnik und Maschinenbau*, Nov. 21, 1920.

Economic Aspects of Extra-High-Tension Distribution by Underground Cable.—R. O. KAPP.—In this paper the chief points considered are (1) the choice of the most economical position for the power and transformer



COST COMPARISON OF UNDERGROUND TRANSMISSION-LINE VOLTAGES

houses; (2) the choice of the most economical voltage; (3) various types of cable lay-out; (4) means of insuring that all radial feeders shall be fully loaded; (5) methods of making fullest use of the current-carrying capacity of cables; (6) the adoption of tariffs for obtaining the best use of the distribution system. An interesting diagram shows the cost of transmission line equipment for the three main voltages in use.—London *Electrician*, Dec. 3, 1920.

Traction

Changes in Electric Locomotives to Meet Demands for Heavier Duty.—GRAHAM BRIGHT.—The locomotives, the author says, are built more rigidly than formerly and offer greater protection for the motors. The largest mine locomotive is described as weighing 35 tons and having three 85-hp. commutating-pole ball-bearing motors cooled by ventilating fans. This locomotive is said to be capable of hauling 100 cars up a grade exceeding 3 per cent where otherwise seventy cars would be the limit. Storage-battery locomotives are also described.—*Coal Age*, Jan. 13, 1921.

Electric Railway Contact Systems.—PHILIP DAWSON.—A comprehensive discussion of the relative merits of contact systems, including both direct-current voltages up to 3,000 and alternating voltages from 6,000 to 16,000, also 3,000 volts to 5,000 volts three-phase. Experience with third-rail and overhead conductors both in the United States and in Germany is reviewed, with some comparison of the cost of maintenance in each system.—*Journal Institution of Electrical Engineering*, London, September, 1920.

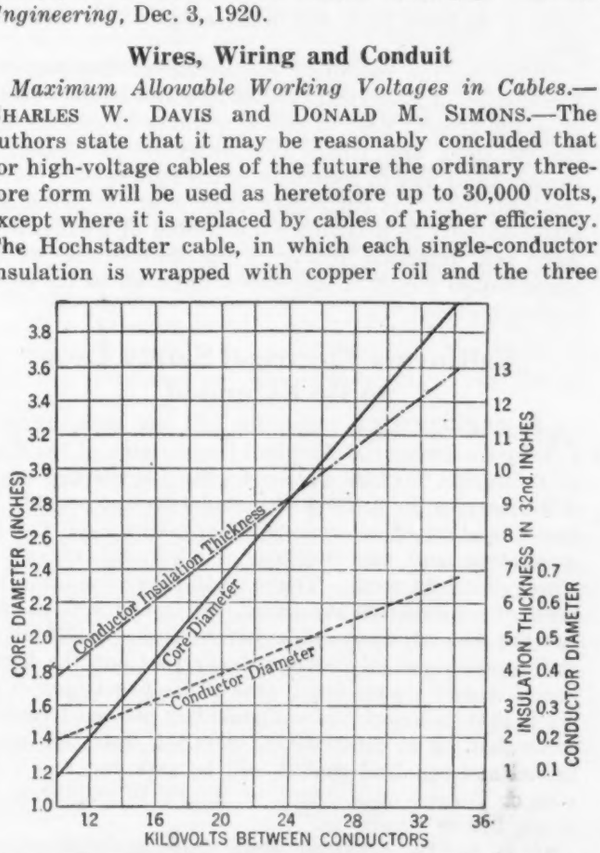
Installations, Systems and Appliances

Three-Phase Current-Limiting Reactors. — M. E. SKINNER.—The author tells what connections are necessary in three-phase reactors to obtain balanced voltage, since the mutual inductive effects are different in different positions of coils. A satisfactory arrangement is to mount the coils one above another, but to split one coil, mounting one-half below and one-half above the other coils.—*Electric Journal*, January, 1921.

Magneto Testing and the Choice of a Spark Gap.—A. P. YOUNG.—The writer considers the commercial testing of magnetos, which may be divided into two parts—(1) a determination of low-speed sparking characteristics of the machine; (2) an endurance test of many hours' duration at a speed well above the normal working speed to thoroughly test the mechanical and electrical components. The impulse ratio of spark gaps is considered and data for pointed and sphere gaps are shown. The other factors to be taken into account are (1) the shape and disposition of the electrode; (2) the material of which they are made (in slight degree); (3) the nature of the gaseous medium surrounding the electrode; (4) the density of the gaseous medium; (5) the degree of turbulence existing in the gaseous medium, and (6) the direction of the current in the gap.—London *Engineering*, Dec. 3, 1920.

Wires, Wiring and Conduit

Maximum Allowable Working Voltages in Cables.—CHARLES W. DAVIS and DONALD M. SIMONS.—The authors state that it may be reasonably concluded that for high-voltage cables of the future the ordinary three-core form will be used as heretofore up to 30,000 volts, except where it is replaced by cables of higher efficiency. The Hochstadter cable, in which each single-conductor insulation is wrapped with copper foil and the three



SMALLEST POSSIBLE TRIPLEX CABLES WHEN THE MAXIMUM STRESS IN THE INSULATION IS LIMITED TO 25 KV. PER CM.

cabled together without belt, on account of its carrying capacity and high permissible working stress, can be used from a few kilovolts up to 50,000 volts. Three single-conductor cables could be used at wider ranges than this, but, owing to the difficulties of induced sheath currents and voltages and their higher cost, their use would, according to the authors, probably not be good economy until the higher voltage limit is reached, unless such large amounts of power are involved as would require more than three triplex cables of the maximum size considered practical. Extensive data are given concerning the installation of cables of various sizes and designs. The curves shown are calculated for cables in which the belt insulation thickness is equal to the conductor insulation thickness. Additional curves give for each voltage the size of conductor and insulation thickness which will produce the cable of minimum diameter.—*Journal A. I. E. E.*, January, 1921.

Electrophysics and Magnetism

Electricity and Gravitation.—H. BATEMAN.—It is suggested that gravitation may be an effect arising from fluctuations of the electric charges associated with the electrons and positive nuclei of atoms. It is assumed (1) that the ether contains an enormous number of electric doublets moving in all directions with the speed of light, (2) that each charged particle is continually both absorbing and emitting doublets at a rate proportional to its mass, and (3) that during the absorption and emission of each doublet the charge on the particle fluctuates. If these fluctuations exist, it is shown that the mean value of the force exerted by one charged particle on another includes, in addition to the ordinary electrostatic force, an attraction proportional to the product of the masses. If it be supposed that the doublets emitted by a particle possess available energy only when the energy of the particle changes, and that the effect of changing the energy is to produce periodic gaps in the emission of doublets with a frequency proportional to the amount of energy lost, there results a theory said to be compatible with the theories of Bohr, Planck and Einstein.—*Physical Review*, January, 1921.

Spark-Over Voltages Through Air.—W. S. FLIGHT.—In this series of articles, which was begun in the October number, the writer considers voltage distribution over suspension or strain insulator strings and important considerations in the testing of porcelain insulators.—*Beama*, December, 1920.

Nature and Explanation of the "Motor Effect" in the Ajax-Wyatt Furnace.—E. F. NORTHRUP.—It is stated that whenever a high-density current, direct or alternating, flows in a liquid conductor motions of the liquid of considerable magnitude are always produced. This phenomenon is called motor effect. The analysis given considers the nature and cause of the fluid motion which occurs in the apex of a fluid triangular conductor, such as is employed in the secondary of the Ajax-Wyatt furnace.—*Journal of Franklin Institute*, December, 1920.

Telegraphy, Telephony and Signals

Telephoning Over the Lighting Mains.—BELLEVILLE.—In a brief note communicated by the technical commission of the French Syndicate of Producers and Distributers of Electrical Energy a device is described by the aid of which a line between a generating station and a substation may be utilized both for telephone communication between the two stations and for lighting, heating or storage-battery-charging purposes. The line is normally connected for power service, but as soon as the receiver is lifted off the hook on any telephone apparatus on the system the line is disconnected from the power supply by means of relay-operated breakers and is instead connected to the telephone system.—*Revue Générale de l'Electricité*, Nov. 27, 1920.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Hoover Expected to Outline Federation's Industrial Relations Plan Feb. 14

ON FEB. 14 the executive board of the American Engineering Council of the Federated American Engineering Societies will hold sessions at Syracuse, N. Y., culminating in the evening in an address by Chairman Herbert Hoover, who it is expected will outline the new council's plans for dealing with industrial relations and particularly with human waste as it affects the present army of unemployed.

The Syracuse meeting will mark the beginning of a movement to organize the engineers on a territorial basis. As a result of a report submitted to the council by Mr. Hoover, the council, it is stated, will probably encourage the formation of state engineering councils, a process already under way in many states, including Massachusetts and Minnesota. A federation of New York State engineers, it is said, is a probability of the near future.

Electrical Manufacturers to Elect New Governors at Annual Meeting

IN ADDITION to the regular business to come before the annual meeting of the Associated Manufacturers of Electrical Supplies, which will be held March 15 at the offices of the association in New York, there will be an election of five governors to take the places of the retiring members of the board whose terms expire.

Within the past year the general standards committee of the association has considered various matters of standardization, and the library and publication committee will shortly issue these standards in regular form to all association members. Bulletin No. 25, recently issued by the association, sets forth briefly the objects, aims, activities and accomplishments of the association since its organization in 1915. This bulletin also gives the names of past-presidents, officers and board of governors and shows the wide scope of the work of the various sections of the association.

This Week's New Financing Totals $18,500,000

FOUR new issues by electric light and power companies, totaling $18,500,000, were offered this week. The largest was $10,000,000 first and refunding mortgage series A 7 per cent sinking fund gold bonds of the Ohio Power Company, maturing in 1951 and sold at a price to yield the investor 7.4 per cent. An issue of $5,000,000 general and refunding mortgage twenty-five year 6 per cent gold bonds of the Southern California Edison Company was offered to yield the investor 7.1 per cent. The Oklahoma Gas & Electric Company sold $2,500,000 ten-year bond-secured 8 per cent convertible gold notes at a price to yield a little over 8½ per cent. The fourth issue was $1,000,000 one-year 8 per cent gold notes of the Wisconsin-Minnesota Light & Power Company at 99, yielding 9 per cent.

Of the four issues it will be noted that the first two are for comparatively long terms and were sold at prices to net the purchaser under 7.5 per cent, while the other two issues, totaling $3,500,000, are for ten-year and one-year terms and yield 8.5 and 9 per cent respectively.

Contractor-Dealers to Promote Good Will for Electric Utilities

APPRECIATING that the growth of the industry as a whole depends largely upon the ability of the electric utilities to obtain money for expansion and development, the executive committee of the National Association of Electrical Contractors and Dealers at its annual meeting in New York last week adopted the following resolution:

"Whereas the executive committee of the National Association of Electrical Contractors and Dealers recognizes the present need of public utilities in general, and electric light and power companies in particular, to further their sale of securities to the public, be it hereby resolved, that this committee shall offer its moral and active support in promoting the feeling of good will toward said interests and urge the membership of the organization which it represents to do all in its power toward that end."

California Electrical Safety Laws to Be Extended

AN ELECTRICAL inspection bill has been prepared by the Industrial Accident Commission of the State of California for submission to the Legislature which will prescribe the method of installation and provide for the inspection of all electrical apparatus used for the generation and consumption of electrical energy in places of employment. The act will cover the establishment of construction standards, the issuance of permits for the use of electrical apparatus, the qualifications and appointment of electrical inspectors and the licensing of master electricians. One of the provisions of the act is that "all electrical equipment in places of employment shall be so constructed, installed, operated, maintained and repaired that it will be safe and free from risk or danger of accident or injury to employees by shock, fire or otherwise."

It is to be provided that duly qualified master electricians may issue permits to energize and operate electrical equipment. Inspections may be made by the regular inspectors of the commission or by qualified municipal or county inspectors. The bill has been drawn up in its present tentative form by the Industrial Accident Commission in full co-operation with representatives of the several branches of the industry. Passage by the Legislature is expected within three months.

"Journal of Electricity" Enlarges Its Scope

ENLARGEMENT of the editorial scope of the *Journal of Electricity* and a change in its name to *Journal of Electricity and Western Industry* were announced at a dinner given on Feb. 1 in the Palace Hotel, San Francisco. The date marked the thirty-fifth anniversary of the *Journal of Electricity*, which has been one of the McGraw-Hill publications since September, 1919. Robert Sibley will continue as editor of the enlarged paper.

The *Journal of Electricity and Western Industry* will be devoted to the upbuilding of the West as an industrial section, and it will interpret Western progress through the application of electric power, light and heat in industries and homes. In its enlarged scope the publication will record the progress of the far West not only of the electrical industry as such but also of all industry dependent upon electrical energy. The fullest editorial support will be given to financing the huge building programs of the Western electrical utilities in the development of hydro-electric power, as this is held to be the greatest single asset of the West.

The tremendous value of utilized water power was emphasized by John A. Britton, vice-president and general manager Pacific Gas & Electric Company, who was among the speakers at the dinner, and the relation of industrial research to the use of this energy was explained by Dr. B. M. Rastall, industrial manager San Francisco Chamber of Commerce. "The Real Vision of the Industrial West and its World-Wide Meaning" was the topic of F. T. Griffith, president Portland Railway, Light & Power Company, and E. S. Carman, president American Society of Mechanical Engineers. "Civic Growth and Its Place in Industry" was discussed by M. M. O'Shaughnessy, "Finance and Industry" by C. F. Stern and "The Aid that Helpful Utility Regulation Can Give Industrial Growth" by E. O. Edgerton. Dr. David P. Barrows, president of the University of California, spoke on "The University Ideal and the West."

Among the prominent men of the electrical industry present were Dr. Thomas A. Addison, Pacific Coast manager General Electric Company; A. C. Balch, vice-president San Joaquin Light & Power Corporation; R. H. Ballard, vice-president and general manager Southern California Edison Company; W. A. Brackenridge, vice-president Southern California Edison Company; Wiggington E. Creed, president Pacific Gas & Electric Company; Mortimer Fleishhacker, president Great Western Power Company; H. F. Jackson, general manager Great Western Power Company; S. M. Kennedy, vice-president Southern California Edison Company; F. A. Leach, Jr., vice-president and assistant general manager Pacific Gas & Electric Company; W. G. Kerckhoff, president San Joaquin Light & Power Corporation; Paul B. McKee, general manager California-Oregon Power Company; A. B. West, vice-president and general manager Southern Sierras Power Company; A. G. Wishon, managerial director San Joaquin Light & Power Corporation, and A. E. Wishon, general manager San Joaquin Light & Power Corporation. Among the hundred guests were included prominent representatives of the banking, irrigation, agricultural and manufacturing interests of the entire West.

Plan to Settle Springfield Dispute

A STEP toward the settlement of the dispute between the city of Springfield, Ill., and the Springfield Gas & Electric Company was taken on Tuesday of this week, when an agreement between the city and the company was signed under which a company to be known as the Citizens' Electric Company will be formed to take over the electric and heating properties of the present company and in turn lease them to the city for municipal operation. Under the terms of the agreement securities of the new company are to be sold to produce a cash sum of $500,000 which will be paid at once to the Springfield Gas & Electric Company. The city will also issue bonds to the extent of $500,000, the proceeds to be used for the outright purchase of certain parts of the steam-heating system. An arbitration board will determine the value of the properties, and the excess over the cash payment of $1,000,000 will be paid semi-annually in advance, mortgage bonds at 7 per cent being issued to secure the balance due. While the agreement has been signed, it has yet to be ratified by a vote of the people on the bond issue to be taken on or before July 31.

More Than $40,000,000 of Electric Utility Financing in January

JANUARY, 1921, saw two new records in electric light and power company financing. The total for the month, $40,584,000, exceeds that for October, the record month of 1920, by more than $2,000,000. Another record is found in the 9 per cent yield on a million-dollar-issue of the Wisconsin-Minnesota Light & Power Company which was sold at 99 to mature in a year. There was no issue in this class of securities in 1920 that carried so high a yield. Another short-term issue amounting to $7,500,000 in two-year gold notes was offered by the United Gas Improvement Company to yield 8.30. This month's table as it appears below shows, however, that long-term issues predominate.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Per Cent Yield	Offered At
Oklahoma Gas & Electric Co.	$2,500,000	10-year	Bond-secured convertible gold notes	Refunding	8	8.5	96½
Ohio Power Co.	10,000,000	30-year	First and refunding mortgage, series A sinking fund gold bonds	Refunding	7	7.4	95½
Wisconsin-Minnesota Light & Power Co.	1,000,000	1-year	Gold notes	Refunding	8	9	99
Southern California Edison Co.	5,000,000	25-year (due Feb. 1, 1944)	Gold bonds	.....	6	7.10	87.50
United Gas Improvement Co.	7,500,000	2-year	Coupon gold notes	Refunding	8	8.30	99.45
Southwestern Power & Light Co.	1,250,000	20-year	Bond-secured gold notes	New construction	8	8.30	97.00
Empire District Electric Co. (Mo.)	1,725,000	28-year, 9 month	First-lien and general-mortgage gold bonds	New construction	8	8.15	98.25
Mississippi River Power Co.	3,600,000	15-year	Sinking-fund gold debentures	Refunding	7	8	91½
Detroit Edi on Co.	5,532,600	10-year	Convertible debenture gold bonds	.....	8	8	Par
Little Rock Railway & Electric Co.	700,000	1-year	Bond-secured gold notes	.....	8	8	Par
Lowell Electric Light Corp.	1,176,400	.....	Stock	Floating debt and new construction	...	...	115
Trenton (Mo.) Gas & Electric Co.	100,000	5-year (due Oct. 1, 1925)	Gold notes	.....	8	8.38	98½
Utah Power & Light Co.	500,000	20-year	First lien and general mortgage	.....	7	7.30	97
Total	$40,584,000						

Would Prohibit New Jersey Utilities from Raising Rates for One Year

THE New Jersey Legislature is considering a bill prohibiting public utilities in the state from increasing rates for service. The measure defines utilities as "every railroad, express, electric light, heat and power, street railway, canal, subway, gas, water, sewer, telephone and telegraph corporation, association, or joint stock company." Any such operating for public use shall not increase its rates within a year after the passage and approval of the bill. The statement attached to the measure sets forth that "the purpose of the bill is to protect the public against unreasonable increases in rates by public utility corporations."

New York Utility Men to Hear About State Water-Power Situation

AT THE meeting of the electric production and distribution sections of the Empire State Gas and Electric Association to be held in Rochester, N. Y., Feb. 10 and 11, one of the principal addresses will be the "Hydro-Electric Situation in New York," by Col. John P. Hogan, one of the associates of Col. William Barclay Parsons, who has been actively engaged in an investigation of the water-power resources throughout the state. Papers which will be presented at the meeting are: "Use of Aërial Power Cables," by Francis A. Westbrook; "Testing High-Tension Insulators Before and After Installation," by E. P. Peck, and "Problems of the Small Plant," by F. A. Dresser.

Other topics to which time has been allotted for discussion are: "Preservative Treatment of Cross-Arms," "Parallel Operation of Single-Phase Transformers," "What Is Being Done by Member Companies to Conform with the Bureau of Standards Covering Line Construction," "Résumé of the Policies of Various Companies Regarding Charges to Consumers for Service Extensions," "Control of Voltage on Long Commercial Circuits" and "Grounding Transformers." There will also be five fifteen-minute talks by superintendents of electric departments on departmental organization in central stations.

New England Electrical League Well Launched

TWENTY-FIVE per cent minimum increase in business during 1921 for the electrical industry of New England was sounded as the slogan for the year by Bowen Tufts, president New England Geographic Division, N. E. L. A., at the organization dinner of the New England Electrical League in Boston Jan. 26, referred to briefly on page 277 of the Jan. 29 issue of the ELECTRICAL WORLD. The responsiveness of the electrical trade to vigorous development work was cited, Mr. Tufts pointing out that in one New England town of about 9,000 residents in December, 1920, a combination house-wiring offer by a contractor-dealer and the outlay of $25 in press advertising resulted in forty-five wiring jobs and the sale of forty-five appliances, amounting together to more than $4,000. From this dealer's efforts the jobber received $1,300 worth of business, the manufacturers $1,100, and the public was saved about $500, due to the handling of the business at a slightly lower rate than would have been the case on single jobs.

Chairman Attwill of the Massachusetts Department of Public Utilities emphasized the right of utility managements to have the *opportunity* to earn a fair return on their company investments. William L. Goodwin, describing the development of electrical leagues in various parts of the country, stressed the importance of the "exchange of service beyond agreement." Olin W. Hill of the Babson statistical organization discussed the value of the domestic load. President Martin J. Insull of the national association touched upon the opportunities before the industry along the general lines followed in his address at the noonday luncheon of the New England Division.

Frank S. Price, Boston, chairman of the organization committee, presented a printed report describing the committee formations in the new development work to be carried forward during the year. The organization of the electrical development committee was given in the ELECTRICAL WORLD of Jan. 29, 1921, page 280. Other committees and their chairmen are as follows: Monthly sales effort, Frank J. Allen, Boston; advertising, W. F. Abely, Boston; data, C. B. Burleigh, Boston; conference, Fred H. Smith, Worcester; organization (relations with other bodies), George H. Cox, Boston; adjustment, A. J. Hixon, Boston.

Super-Power System for Indiana

ALL branches of engineering were represented at the forty-first annual convention of the Indiana Engineering Society in Indianapolis last week and the electrical section of the program, under the auspices of the Indianapolis-La Fayette Section of the American Institute of Electrical Engineers, was exceptionally strong.

In the development of rural business central stations have paid little or no attention to the farmers' viewpoint and to their process of reasoning, according to Professor D. D. Ewing of Purdue University, who said in an address on rural service problems that utility companies should use proved merchandising methods in selling electric service to rural communities, that farmers should pay for the lines and should then lease the lines to the electric utility company at a nominal rental.

A superpower station and transmission system were proposed for Indiana in a paper by Frederick L. Ray of Anderson, Ind.

W. J. Titus and Charles Brossman, both of Indianapolis, were re-elected president and secretary respectively of the Indiana Engineering Society. A. A. Potter, dean of engineering at Purdue University, West Lafayette, Ind., was elected vice-president, and the new trustees were R. C. Yoeman, Indianapolis, and R. E. Gibbon, Terre Haute.

Ten Million Dollars of Common Stock Authorized for Sale to Consumers

THE Southern California Edison Company has been authorized by the California Railroad Commission to issue $10,000,000 of its common stock for sale at not less than $90 per share. The company is planning to sell all of this stock locally to its consumers within the year. Recently $10,000,000 of 6 per cent, twenty-five-year gold bonds were issued and sold by the Southern California Edison Company. The returns from the two issues, it is expected, will provide sufficient capital to finance the hydro-electric developments and the extensions to the transmission and distribution systems of the company during the year 1921.

New York Holds Successful Electric Vehicle Show

THERE opened in New York on Jan. 29, to continue for two weeks, an exhibit of electric vehicles and accessories. The first week was devoted entirely to road truck and passenger vehicles and accessories, and the second week will be devoted to the industrial truck. The exhibit is being held in the showrooms of the New York Edison Company, normally devoted to domestic appliance exhibits. The entire room has been given over to the vehicle show without cost to the exhibitors as part of the Edison company's plan to promote the greater use in New York of all kinds of electrical applications.

New York is probably the greatest market for the electric road truck in the country. More than five hundred enterprises are now using in the aggregate in the metropolitan district almost 5,000 electric trucks and delivery wagons, some of which have been in service twenty years and more. The largest installation is a fleet of 319 vehicles.

Among the companies exhibiting are the following:

Commercial Trucks.—Commercial Truck Company of America, Lansden Company, Oneida Truck Company, Walker Vehicle Company (General Vehicle Company), Ward Motor Vehicle Company.

Passenger Cars.—Berg Electric Car Company, Rauch & Lang, Inc.

Industrial Trucks.—Automatic Transportation Company, Baker, R. & L., Cowan Truck Company, Elwell Parker Company, Hoagland Thayer Company, Industrial Truck Company, Karry-Lode Industrial Truck Company, Lakewood Engineering Company, Mercury Manufacturing Company, Terminal Engineering Company.

Battery Manufacturers.—The Edison Storage Battery Company, the Electric Storage Battery Company, General Lead Batteries Company, Philadelphia Storage Battery Company.

Charging Apparatus and Accessories.—A. & J. Anderson Manufacturing Company, Auto Electric Devices Corporation, Allen Bradley Company, Cutler-Hammer Manufacturing Company, General Electric Company, Westinghouse Electric & Manufacturing Company.

RECORD GATHERING AT LUNCH

On Wednesday an electric vehicle luncheon was given at the Hotel Astor, at which former Governor Alfred E. Smith, now president of New York City's largest trucking company; William H. Onken, Jr., editor of the ELECTRICAL WORLD who spoke for James H. McGraw, president, McGraw-Hill Company; Robert E. M. Cowie, vice-president of the American Railway Express Company, and Arthur Williams, general commercial manager of the New York Edison Company and under whose guidance the show is being conducted, were the speakers.

The luncheon brought together probably the largest gathering ever held to pay tribute to the possibilities of electric transportation. Mr. Cowie, who represents the largest single user of electric trucks in the country, painted a picture of the future for "electrics" that left nothing to be desired.

Co-operation of all interests must bring success to the electric vehicle industry, according to Mr. McGraw, and this is exemplified, he said, by the development that has taken place in New York, where the New York Edison Company is actively behind the electric vehicle.

Former Governor Smith, who has but recently come into the trucking field, spoke of the need for concerted action to free New York from traffic congestion.

"It looks now as if the electric vehicle were finally coming into its own," remarked Arthur Williams, while discussing the show with an ELECTRICAL WORLD representative. "Last year 536 'electrics' were sold in New York, valued at $2,680,000, or 452 per cent more than in 1919. There is an investment in the metropolitan district alone of $22,000,000 in electric truck development."

However, as Mr. Williams explained, the New York Edison Company sees in the electric vehicle more than its present dollars-and-cents sales. The Edison company sees the "electric" as ultimately caring for the bulk of the city transportation. Mr. Williams pointed out that it is easier to obtain competent drivers for the electric vehicle, that it has an almost unlimited life because it has so few moving parts, that it can go anywhere without fire risk and consequently saves handling charges, and also that by its inability to attain high speeds it acts as an automatic safety check on the repair account.

It is doubtful, however, in Mr. Williams' opinion, whether the electric vehicle will attain its full possibilities until transportation engineering for secondary work has been more fully developed.

"Electric transportation," said Mr. Williams, "will carry the white man's burden of the future. The heavy truck on the street, the smaller industrial truck in the factory, the lifting platform and the conveyor and many other applications will reduce labor requirements, quicken production and make all heavy lifting and hauling a mechanical rather than a manual operation."

INDUSTRY OPTIMISTIC

More optimism is evident in the electric vehicle business today than ever before. Not so many sales are being made, it is true, but inquiries are coming in every day. The coming year is seen as a year of reducing expenses, and consequently the demand for "electrics" is expected to expand rapidly. As indicative of the point of view in the industry there follow a few expressions of opinion made to the ELECTRICAL WORLD by various manufacturers:

Road-truck business looks decidedly promising at the present time to the Ward Motor Vehicle Company, Mount Vernon, N. Y. The factory is working overtime and shipping its cars much the same as last year. To a certain extent this is due to back orders. Bookings have dropped somewhat recently, but nothing to be compared with the recession in other industries. On the other hand, there is considerable encouragement in the type and volume of inquiries received. These for the most part are from dealers in essential commodities.

ENCOURAGING INQUIRIES

Industrial truck business looks particularly good. The Baker R. & L. Company is encouraged to the extent of making an additional stock investment of finished trucks and tractors of $250,000. The Karry-Lode Industrial Truck Company is receiving numerous inquiries every day. The Lakewood Engineering Company reports substantial sales. The Elwell Parker Company is going ahead with many new developments.

Reports of battery business, which is a barometer of electric vehicle conditions, confirm the statements of the truck and car manufacturers. Both the Philadelphia Storage Battery Company and the Edison Storage Battery Company report that business has turned the corner and that, while current sales are not so large as formerly, the volume of inquiries is growing rapidly.

California-Oregon Has Reorganization Plan to Reduce Capitalization

THE California-Oregon Power Company, which operates in southern Oregon and three counties of California, has applied to the California Railroad Commission for an order approving a reorganization plan proposd by a bondholders' committee. In addition the company asks that the new company formed as a result of the recommendations of the bondholders' committee be authorized to create a bonded indebtedness of $10,000,000 to obtain funds to meet the cost of necessary extensions and betterments and to meet underlying bond issues as they mature. Authority is also sought to issue 22,200 shares of preferred capital stock and 44,400 shares of common capital stock of the new company. This stock is to be delivered to the present bondholders on the basis of $500 of preferred and $1,000 common for each $1,000 California-Oregon Power Company 5 per cent bond.

The reorganization plan will result in a reduction of $6,062,000 in outstanding securities. It is claimed by the company that the value of its properties in California is $4,320,240, exclusive of its Dunsmuir water properties, said by the company to be worth $127,314.55. To the Oregon properties a value of $2,985,612 is given.

N. E. L. A. No Longer Objects to Oil-Filled Apparatus Safety Rules

REPORTS made to the executive committee of the Technical Section of the National Electric Light Association at its dinner-meeting at the Engineers' Club, New York, on Jan. 19 indicate that the work of the Technical Section is being carried out actively and with excellent co-operation through the several technical committees of geographical divisions. Chairman I. E. Moultrop announced that, although the methods of co-operation pursued are not yet uniform in all respects, progress toward uniformity is satisfactory.

The meetings of the executive committee were well attended, those present at the executive sessions being Chairman I. E. Moultrop, Edison Electric Illuminating Company of Boston; Vice-chairman N. A. Carle, Public Service Electric Company, Newark, N. J.; Vice-chairman H. A. Barre, Southern California Edison Company, Los Angeles; Vice-chairman A. H. Lawton, Consumers' Power Company, Jackson, Mich.; Markham Cheever, Utah Power & Light Company, Salt Lake City; L. L. Elden, Edison Electric Illuminating Company of Boston; L. M. Klauber, San Diego (Cal.) Consolidated Gas & Electric Company; G. E. Lewis, Detroit Edison Company; G. E. Quinlan, Puget Sound Traction, Light & Power Company, Seattle; R. F. Schuchardt, Commonwealth Edison Company, Chicago; A. E. Silver, Electric Bond & Share Company, New York City; W. K. Vanderpoel, Public Service Electric Company, Newark, N. J.; W. L. Wadsworth, Minneapolis General Electric Company; P. Torchio, New York Edison Company; Past-chairman R. J. McClelland, and by invitation, W. J. Canada, George F. Oxley and S. A. Sewall.

After discussion, the committee recommended that the safety rules committee should prepare a statement conveying to the Bureau of Standards the latest information gained by the electrical apparatus committee of the Technical Section with regard to the relative hazards of oil-filled apparatus, and advising the bureau, as a matter of courtesy and frank co-operation, that restrictive rules in the Safety Code appear warranted, although these rules previously were objected to by the committee as not warranted by the experience then in hand. The bureau is to be urged that these rules should be phrased in such a way as to take into consideration factors not adequately considered in rules previously proposed by the bureau for the Safety Code and which were withdrawn by it at the suggestion of the electrical apparatus and safety rules committees.

Chairman Moultrop reported that conferences are being held with engineer representatives of the American Telephone & Telegraph Company with a view to co-operative dealing on mutual inductive-interference problems.

San Francisco Business Men Support State Commission

DEPRECATING unfounded disparagement of the Railroad Commission of California, the San Francisco Chamber of Commerce recently adopted a resolution declaring its confidence that "a fair and impartial examination of the work of the commission will demonstrate its high efficiency and honorable discharge of public duty." It is declared in the resolution that the Chamber of Commerce, "whose membership embraces large users of all characters of public service," has carefully followed the work of the commission and has always found that its decisions have been based on its best judgment, considering the necessities of the situation presented to it. The entire impartiality of the commission's decisions is emphasized.

Seven per Cent Reduction in Southern California Edison Rates

PRELIMINARY to the establishment of complete schedules of revised regular rates, the California Railroad Commission has ordered a reduction from 27 to 20 per cent in the surcharge granted the Southern California Edison Company, which became effective on April 20 last. The reduced surcharge is to continue in effect until further orders by the commission.

The reduced rate is made effective on Jan. 20 throughout the entire territory served by the company, with the exception of that territory in the San Joaquin Valley served by the Mount Whitney Electric Company prior to its consolidation with the Southern California Edison Company. Los Angeles consumers are not affected, because under the terms of the operating agreement the company acts as agent for the city of Los Angeles, collecting on behalf of the city such rates as are fixed by the city itself.

The matter of rates for service charged by the Southern California Edison Company has been under review by the Railroad Commission since last March, when first hearings were held in Los Angeles. Further hearings were held in October, November and December, and an enormous mass of statistical evidence was submitted by the company and by representatives of various agricultural and other organizations.

The evidence submitted in the case showed that the company will have a more plentiful supply of water power during the coming year, as two additional water-power plants are nearing completion. Transferring part of the electrical loads from the steam plants to these new

water-power plants will reduce the amount of fuel-oil purchases and, under the order just issued, a part of this saving is allowed the company's consumers.

Public-Information Conference to Be Held by American Association of Engineers

A "NATIONAL engineering conference on public information" is to be held in Chicago on Feb. 25 under the auspices of the American Association of Engineers. Papers are to be read on such subjects as "Technical News Service," "News Versus Publicity," "How Publicity Helps a Community," "Effective Methods of Publicity Education on Engineering Publications" and "The Engineer as a Public Speaker." Among those who have accepted invitations to prepare papers are F. M. Feiker, vice-president McGraw-Hill Company; John G. D. Mack, State Chief Engineer of Wisconsin; W. W. DeBerard, Western editor of the *Engineering News-Record*, Chicago; William J. H. Strong, head of the Lake Breeze Motor Company, Chicago; C. R. Thomas, in charge of publication of results Forest Products Laboratory, Madison, Wis., and Ivy L. Lee, publicity director of the Interborough Rapid Transit Company, New York.

Ohio Metermen Discuss Power Factor and Line-Loss Measurements

PROBLEMS involved in metering line losses and measuring the power factor of the customer's load were discussed from managerial, operating and metering standpoints at the meter conference held in Cleveland last week under the auspices of the meter committee of the Ohio Electric Light Association.

It was the sense of the meeting that the power factor of customers' installations could be most simply and satisfactorily obtained through the measurements of the energy and reactive components of the delivered kva. Three accurate and practical methods of making these measurements on three-phase circuits were suggested in a paper prepared by J. W. West, Lynn, Mass., and presented in his absence by W. S. Culver, Cincinnati, both of the General Electric Company. Chairman S. C. Henton of Akron voiced the majority opinion in favoring the use of two watt-hour meters and two transformers because this is standard equipment which does not need any special adjustment or special means for testing. On the same subject Ray Wolford of the American Gas & Electric Company presented a paper in which he suggested possible new developments in methods of measuring customers' power factor and kilovolt-ampere-hours.

Another meter described by Mr. West gives line loss when its reading is multiplied by known resistance of the line. This meter is known as the ampere-squared-hour meter and is applicable when the corona losses are unimportant or can be allowed for and where the charging current of the line is not of primary importance. It was brought out in the discussion that these meters run in the same direction irrespective of the direction of power, so that on interconnecting lines where there is an interchange of energy special provision must be made if the losses are to be measured in each direction.

A power schedule with a kilovolt-ampere demand charge, a kilowatt-hour charge and a reactive kilovolt-ampere-hour charge was suggested by H. L. Wallau, Cleveland Electric Illuminating Company, in a paper entitled "Power Factor and Its Measurements." A very constructive paper on the rate engineering of power factor with reference to metering was prepared by F. A. Newton of Hodenpyl, Hardy & Company, Jackson, Mich., and presented by H. H. Coughlan of Akron. Mr. Newton's message was to drop the word "penalty" in referring to charges for low power factor and to realize that the utilities were partly to blame for the present power-factor conditions. It was decided that two days would be given over to the next conference, which is scheduled for Cincinnati on April 22 and 23.

Heavy Power Demand in New Jersey in 1920

ACCORDING to records compiled by the Public Service Electric Company, Newark, N. J., operating in different sections of New Jersey, there was a noticeable increase in power demand in the year just closed. The plants of the company furnished power to the amount of approximately 350,000,000 kw.-hr. for industrial service during 1920, representing about 70 per cent of the total demand. This energy was supplied through a total of about 14,000 power meters. In the lighting branch of the business the increase in this same period totaled about 16 per cent over the year 1919. The advance indicates a large number of newly wired houses. The electric utility did not experience any interruption in service due to the coal situation during the year.

Steps Taken Toward Merger of Washington Power and Traction Properties

DEFINITE action was taken on Jan. 26 by the District of Columbia committee of the House of Representatives looking to the merger of the electric light and power and street-railway companies in the national capital. By a vote of thirteen to one the committee instructed Representative Gould of New York to draft and report favorably to the House a bill removing the statutory prohibition against the consolidation of the Washington Railway & Electric Company and the Potomac Electric Power Company, and a committee of five was authorized to draw up a bill which would bring about a merger of the two Washington traction companies.

It was pointed out that it would be unfair to the Capital Traction Company to put its property into the pool if the Washington Railway & Electric Company is allowed to hold out of the merger its most valuable asset, the Potomac Electric Power Company.

Legislature Quashes California Utility Tax Raise

AFTER a hot fight in the California Legislature to increase the present utility taxes approximately 35 per cent, the move has for the time being met with defeat. The administration forces, under the direct leadership of Governor Stephens, exerted every effort to force the bill through the Assembly after it had carried in the Senate. The Governor has begun a statewide campaign to arouse public sentiment in favor of the bill during the thirty-day recess of the Legislature. If carried as proposed, the taxes on the electrical utilities will be increased from about 5.5 per cent to 7.5 per cent of the gross income.

A. I. E. E. Issues Revised Program for Its Midwinter Convention

THE definitive program of the midwinter convention of the American Institute of Electrical Engineers, to be held in the Engineering Societies Building, New York City, Feb. 16-18, has now been issued and includes a number of additions and changes made since the tentative program was printed in the ELECTRICAL WORLD for Jan. 8 (page 111). The program as it stands follows:

WEDNESDAY, FEB. 16

Afternoon.—Board of directors meeting, 3:30 p.m.; trips to local electrical plants.

Evening.—Address by President A. W. Berresford; "Present-Day Practice Limitations of Oil Circuit Breakers," by H. R. Woodrow; "High-Current Tests on High-Tension Switch Gear," by Philip Torchio.

THURSDAY, FEB. 17

Morning.—"The Maximum Safe Operating Temperatures of Low-Voltage Paper Insulated Cables," by W. A. Del Mar; "Permissible Operating Temperature of Impregnated Paper Insulation in Which the Dielectric Stress Is Low," by Philip Torchio; "Permissible Operating Temperatures of Impregnated Paper Insulation in Which the Dielectric Stress Is Low," by D. W. Roper; "Effect of Heat on Impregnated Paper from Cable Insulation," by W. S. Clark; "The Effect of Heat Upon Paper Insulation," by H. W. Fisher and R. W. Atkinson; "Permissible Operating Temperatures of Impregnated Paper Insulation in Which the Dielectric Stress Is Low," by L. L. Elden.

Afternoon.—"Carrier-Current Telephony and Telegraphy," by E. H. Colpitts and O. B. Blackwell; "Some Phases of Railroad Telegraph and Telephone Engineering," by Stanley Rhoads.

Evening.—Dinner dance at Hotel Astor, 7 p.m.

FRIDAY, FEB. 18

Morning.—"Regulation of Frequency for Measurement Purposes," by B. H. Smith; "Measurement of Relative Eddy-Current Losses in Stranded Cables," by J. A. Cook; "An Electromagnetic Device for Rapid Schedule Harmonic Analysis of Complex Waves," by F. S. Dellenbaugh, Jr.; "The Limitations of the Stop Watch as a Precision Instrument," by A. L. Ellis.

Afternoon—"Short-Circuit Current of Induction Motors and Generators," by R. E. Doherty and E. T. Williamson; "Hysteresis Effects with Varying Superposed Magnetizing Forces," by W. Fondiller and W. H. Martin; "Longitudinal and Transverse Heat Flow in Slot-Wound Armature Coils," by Carl J. Fechheimer.

Evening.—Auditorium, 8:15 p.m.: Presentation of the Edison medal to Dr. M. I. Pupin; Lecture, "Wave Transmission," by M. I. Pupin.

Geological Survey's Daily Energy Figures for November Year's Highest

FIGURES of electrical generation by public utilities for the month of November have just been issued by the United States Geological Survey. They show a total of 3,707,365,000 kw.-hr. as compared with 3,735,609,000 kw.-hr. for October. Hydro-electric generation was 47,341,000 kw.-hr. ahead of October, the November figure being 1,384,413,000 kw.-hr. Unlike the central-station statistics published monthly by the ELECTRICAL WORLD, the figures of the Geological Survey include electric railways.

Average daily production of electricity in kilowatt-hours by public utility plants for the first eleven months of the year was as follows: January, 124,700,000; February, 119,800,000; March 120,700,000; April, 119,100,000; May, 115,600,000; June, 118,800,000; July, 116,800,000; August, 119,700,000; September, 120,800,000; October, 120,400,000 and November, 123,600,000. The total output for the eleven-month period from January to November, 1920, was 40,191,000,000 kw.-hr., an increase of about 15 per cent over 1919.

The output for November, 1920, involved the consumption of more than 3,160,000 tons of coal, more than 960,000 barrels of fuel oil and more than 1,855,000,000 cu.ft. of gas.

Consumers' Power to Use Radio Telephones

THE Consumers' Power Company at Jackson, Mich., has announced that wireless telephones will be installed for use in the operation of its system. The decision was arrived at after a thorough investigation by E. B. Morrow, manager of the transmission and production department, into the feasibility of using the instruments.

Telephone Lines Have No Right to Monopolize Highways

WHETHER transmission lines of moderate voltage shall be allowed to occupy the opposite side of the highway from certain long-distance telephone circuits was directly questioned in the application for a certificate of necessity and convenience made to the Public Utilities Commission of Illinois at Springfield this week by the Homer Electric Light & Power Company. The line that the Homer company proposes to build would parallel important toll circuits of the Illinois Bell and American Telephone & Telegraph companies for a distance of approximately 7 miles. On July 31, 1920, the commission refused the application of the Homer company for authority to build a 13,200-volt parallel line to establish service to a coal mine, on the ground that there was another route available, but on Sept. 28, on a showing that thirty-seven property owners along the route originally proposed had applied for service, the commission granted the application, pointing out, after discussing the telephone interference situation, that "in view of the rapid progress in the field of electric transmission the present-day tendency is to generate electrical energy at central stations and distribute it over high-tension lines. This development in the business," the commission continued, "has made it possible for small villages and rural customers to enjoy electric service where it would otherwise not be available. A large number of villages and towns in Illinois are annually being connected to transmission lines, and there is now appearing a tendency toward rapid development in rural communities. Considering that most of the rural roads are now occupied by telephone circuits, the problem of routing electric lines so as not to cause interference with signal circuits is becoming more and more difficult, and while the signal circuits with priority of occupation are entitled to reasonable protection from substantial interference, it does not appear that there is any right on the part of a telephone company to occupy the public highway to the entire exclusion of the electric lines."

The hearing this week was on an application from the telephone companies, one of them alleging that it had not had notice of the hearing on which the certificate of necessity and convenience was granted. The con-

tention made in the testimony this week is that the power company can construct a line of lower voltage along the road, feeding this from both ends and from a 13,200-volt line along the Wabash Railroad right-of-way a short distance away, and that a 13,200-volt line should not be allowed on the highway in question.

The case has assumed national prominence in that the commission order already made involves a clear denial of the telephone companies' right to monopolize the highway, while a reversal of that order would create a precedent against the building of transmission lines in parallel with important telephone toll circuits.

Figures on Changes in Cost of Living

DETAILED figures showing the changes in the cost of living for a standard family, all articles considered, were given out this week for thirty-two cities by the United States Department of Labor through the Bureau of Labor Statistics. Two tables, one giving the changes for nineteen cities from December, 1914, to December, 1920, inclusive, and the other for thirteen cities from December, 1917, to December, 1920, are included.

Electrical Inspectors Recognize Auto-Transformer Hazards

THE hazards involved in the use of auto-transformers for obtaining lighting service from 220/440-volt and other low-voltage power circuits in industrial plants came in for a rather lively discussion at the meeting of the Western Association of Electrical Inspectors at Detroit last week. H. J. Woods of St. Louis illustrated various combinations in connection with grounding whereby abnormal voltages on the lighting circuits could be caused, and a resolution was passed in which the association recognized the hazards and put itself on record as favoring prohibition of the use of auto-transformers or surrounding such use with safeguards that will prevent trouble. The matter is to be discussed with other organizations interested.

Co-operation between the central stations and inspection bureaus was strongly supported by L. D. Smith of the Minneapolis General Electric Company, and as a step toward greater co-operation the revised articles of the association adopted provide for one associate and one industrial member on the executive committee. Associate members include among others those supervising or inspecting electrical installations for public service companies, while industrial members include contractors, engineers and manufacturers.

Frank R. Daniels of Milwaukee in discussing inspectors' problems pointed out the need of educating and co-operating with the smaller cities and towns where it is difficult to insure proper wiring and where spasmodic inspection has been more or less of a failure. The educational program adopted by the inspectors' association in Wisconsin was described briefly by Mr. Daniels.

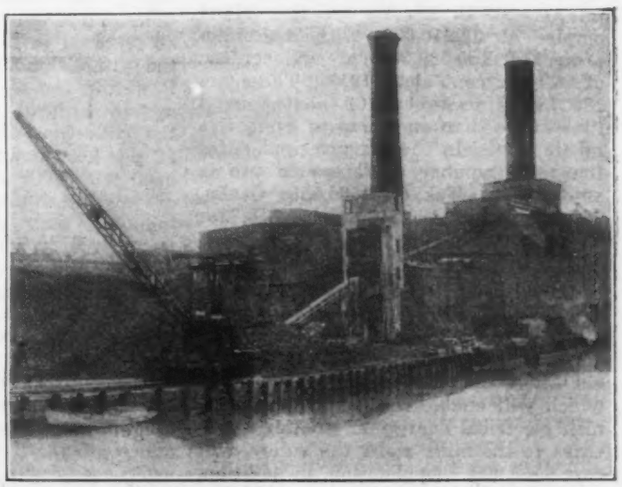
The committee reports on Thursday were the subject of animated discussions, the most important being that on the motor-wiring tables. These have been presented at previous meetings, and the crux of the discussion last week concerned the advisability of limiting the fuse sizes to the safe carrying capacity of the wires protected. A rather prevalent opinion was that on motor circuits where starting loads are short and danger of overheating conductors is small the present limits as to fusing may force the use of conductors larger than are economically justified. The report, which was on the installation and operation of induction motors, was referred to the committee for further study. A resolution was passed indicating that the association would confine its attention on overhead-line construction to matters involving direct fire hazards. These items are largely the transformer and service installations in close proximity to buildings.

The following officers were elected: President, J. H. Fenton; first vice-president, O. M. Frykman; second vice-president, F. O. Evertz; secretary-treasurer, W. S. Boyd; executive committee, Frank Anderson (chairman), William A. Haig, J. S. Mahan, L. A. Barley, J. W. Strub and H. J. Clark.

British Columbia Now Requires Registration of Engineers

AN ACT recently passed by the Legislature of British Columbia incorporates the Association of Professional Engineers in that Canadian province and requires that all persons practicing as "professional engineers" shall register as members of this body. Civil, mining, mechanical, electrical, chemical and structural engineers come within the provisions of the act, but not architects. Those who had practiced in the province for five years prior to the passage of the act may register without an examination up to April 1, 1921, as many engineers who served as such in the war. Temporary licenses to practice may be given to non-residents of the province. An executive council for the association is to be elected by the membership, and this council is to appoint annually a board of examiners which shall examine candidates for membership. The annual fee is to be determined by the association when it draws up its by-laws.

One of New England's Most Efficient Plants



BY INTERCONNECTION with electric light and power plants at Walden, Revere and Boston this steam plant of the Salem (Mass.) Electric Lighting Company has effected an estimated saving of coal reaching 1,200 tons per year. Since 1914 the output of this plant has increased from about 9,000,000 kw.-hr. to 43,000,000 kw.-hr. per year. This is one of the most efficient plants in New England, generating a kilowatt-hour on about 1.8 lb. of coal.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Victoria Falls Again to the Front.—The long-talked-of hydro-electric plant at the Victoria Falls, on the Zambezi River, in South Africa, has come up for discussion again owing to the high cost of coal, and it is said to be probable that work will soon begin on a 250,000-hp. plant.

New Figures on Spanish Water Power.—Statistics published by a Spanish electrical association for 1920 show a total of 618,756 hydro-electric horsepower in use in Spain, compared with 348,297 in 1917. Thus 10 per cent of the potential horsepower, placed at 6,000,000, has been actually developed. At the rate of 1 hp. to 6 tons of coal, it is prophesied that in four or five years production by water power will equal production by fuel.

Y. M. C. A. Courses in Electricity and Illumination.—The Central Technical School of the Chicago Young Men's Christian Association announces two new evening courses to cover fifteen weeks each—one in illuminating engineering and one in applied electricity. The instructor for both courses is Edwin D. Tillson, a testing engineer with the Commonwealth Edison Company, and there will be two sessions of an hour and a half's duration in each course every week.

Electric Lighting in Japan.—Figures recently published by the Japanese authorities put the total number of electric lamps in service in the island empire at 12,210,000, with a candlepower of 150,000,000, or an increase of 800 per cent since 1910. There are 180 lamps to every 100 homes, or a little more than one lamp to every five inhabitants. In the six principal cities the total number of lamps in use is as follows: Tokyo, 1,684,533; Osaka, 842,491; Kioto, 400,413; Kobe, 318,328; Yokohama, 255,008; Nagoya, 202,315.

Power Projects on the Wisconsin River Under Way.—The Wisconsin Valley Electric Company of Wausau is making rapid progress with its dam across the main channel of the Wisconsin River at that place. This dam, which will enable the company to furnish electrical energy in greater quantities to the mills along the valley, will cost $750,000. Application, in addition, has been made by the Wisconsin Valley Improvement Company to the Railroad Commission of the State for permission to construct a reservoir near Tomahawk, about 40 miles above Wausau, where the Spirit River empties into the Wisconsin. It is planned to spend $100,000 there and to impound 50,000,000 cu.ft. of water, which will provide an increase of electrical power in that district of from 9 to 10 per cent.

Customers' Good Will Fails to Bring Higher Rate for Electric Utility.—An instance of public support for an electric light and power company asking higher rates recently arose in Rockford, Ill., where the Rockford Electric Company asked permission from the Illinois Public Utilities Commission to raise its commercial lighting rates 30 per cent and submitted letters from several of its patrons in which the company's service was complimented and a willingness to pay higher prices if necessary expressed. No protest against the application was filed with the commission by the city or any of the company's customers. Notwithstanding these facts the commission refused to entertain the application.

Water Power in the Scottish Highlands.—The familiar Scottish names "Lochaber" and "Grampian" figure in two measures now pending in the British Parliament for promoting private development of hydro-electric power sources in the Highlands. Authority is sought to use the waters of many specified lochs, rivers and streams and to construct the requisite dams and reservoirs. The Lochaber scheme, to cost £2,962,000, is said to have aroused little local opposition and to have a good chance of becoming law, but the Grampian scheme, to cost £1,000,000, is attacked as being designed to benefit only the manufacturers of Dundee and Perth. Signs that both projects will be attacked by those primarily interested in the preservation of Highland scenery and resentful of the intrusion of industry are not wanting.

Minister of Power and Aid to Rural Distribution Recommended for Ontario.—A committee appointed by the Legislature of the Province of Ontario to report on rates for Hydro-Electric Commission power has recommended, as reported in the *Canadian Engineer*, the establishment of a Department of Power in the Ontario government, the appointment of a Minister of Power, the collection of an annual rental of $2 per horsepower on all power developed within Ontario, and the granting of provincial assistance to all municipalities that pay more than $30 per horsepower for "Hydro" power. "Where power is supplied to the agricultural industry," the report says, "then the Minister of Power may give further assistance by granting the local commission of such municipality a sum sufficient to meet the whole or part of the annual charge necessary to pay for the cost of construction and maintenance of the low-tension lines which are necessary for rural distribution, but one of the conditions upon which such assistance may be given is that there must be an average of three services a mile in the rural district served, and the total expenditure for such assistance shall not exceed 50 per cent of the revenue derived from power rentals."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

New Mexico Electrical Association.—The New Mexico Electrical Association will meet in convention at Albuquerque on Monday and Tuesday, Feb. 14 and 15.

Wisconsin Electrical Contractors and Dealers' Association.—This association elected the following officers at its recent annual convention in Milwaukee: President, B. L. Burdick, Milwaukee; vice-president, William F. Meter, Oshkosh; acting secretary, H. M. Northrup, Milwaukee; secretary and treasurer, John L. Acker, Sheboygan.

Southern Operating Men to Form Organization.—As the result of a conference held last December at Parksville, Tenn., between representatives of seven large power companies the idea of forming a permanent association was indorsed. A constitution and by-laws are being drawn up, and it is expected that other companies will join those now backing the movement. The next meeting will be held in Atlanta under the auspices of the Georgia Railway & Power Company in the first part of April.

Institute of Radio Engineers.—The annual election of officers recently held by the Institute of Radio Engineers resulted in the choice of E. F. W. Alexanderson as president, Fulton Cutting as vice-president, A. N. Goldsmith as secretary and W. F. Hubley as treasurer. The board of direction of the institute is made up of the officers and the following managers: E. H. Armstrong, W. H. G. Bullard, E. H. Colpitts, L. Espenschied, J. V. L. Hogan, L. R. Krumm, R. H. Marriott, Donald McNicol and George O. Squier.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Philadelphia, Section, Feb. 5; Cleveland Section, Feb. 14; Birmingham Section, Feb. 19; Chicago Section, Feb. 19.

Florida Engineering Society — Lakeland, Fla., Feb. 7 and 8.

American Institute of Electrical Engineers—Portland (Ore.) Section, Feb. 7; Chicago Section, Feb. 28.

A. I. E. E., A. S. M. E. and A. S. C. E. (joint meeting)—Boston, Feb. 8.

New Mexico Electrical Association—Albuquerque, Feb. 14 and 15.

American Institute of Mining and Metallurgical Engineers — New York, Feb. 14-17.

A. I. E. E.—Midwinter convention, New York, Feb. 16-18. (For program see News of the Industry.)

American Physical Society — New York Feb. 25 and 26.

Wisconsin Electrical Association—Milwaukee, March 23 and 24.

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section) — New York, March 25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Free Service by Municipal Plant Illegal.—Under the state statutes it is unlawful, the Indiana Public Service Commission has announced, for a municipal plant to render free service or service at special rates to any consumer. The commission disclaims jurisdiction to pass upon the question whether or not a municipal utility can recover from a charitable institution for past free service.

Twenty-four-Hour Service Compelled.—The Eastern Montana Light & Power Company has been required by the North Dakota Board of Railroad Commissioners to render twenty-four-hour service in cases where the board held that a discontinuance of such service would be a hardship to consumers who had purchased power equipment which would be rendered valueless upon a cessation of day service.

Abandonment of Service Authorized.—In granting permission to E. F. Chambers, operating a gas plant at La Junta, Col., to discontinue service and dismantle the plant the Colorado Public Utilities Commission said: "This involves a question of the authority of the commission to compel the owner to invest additional money in the equipment of a utility that has heretofore been a losing venture. It is asserted in the pleadings of the protestants that it is the duty of the owner of a utility so to do and within the power of the commission to compel its being done. But we have not been cited to any legal authority in support of such proposition, nor do we know of any such authority. Therefore the commission holds that it is without power to order it to be done, and that it is not the legal duty of the owner further to invest his capital in the operation of a utility that experience has proved to result in financial loss."

Contract Rates Which Are Not Discriminatory or Unreasonable Defended Against Supersession.—In the case of H. C. Frick against the Duquesne Light Company and the Allegheny County Steam Heating Company, protesting against the supersession of contract rates entered into for a five-year period, the Public Service Commission of Pennsylvania held that the parties to the dispute having agreed that the filed rates were reasonable and would remain stable for a period of at least five years, and the complainant having incurred extraordinary expenses upon that assumption, no ground of public policy existed which required that their joint judgment be set aside until or unless it could be shown that the time element which they had fixed to the legal rate had resulted or would result in a discriminatory or preferential situation inimical to other patrons or the public at large, or that the rates had become so unjust and unreasonable that they should be abrogated on the ground of public policy.

Return of 8.4 per Cent Indicates Prosperity.—Declining to grant an increase in rates for electrical energy asked by the Eastern Wisconsin Electric Company at Fond du Lac, the Wisconsin Railroad Commission observed: "Using the company's figures as they are submitted and without questioning at this time the propriety of the various elements, we find that the annual return will be 8.4 per cent. We are certain, therefore, that the business, at least as far as this particular department is concerned, has been and still is prosperous."

Surcharge and Fuel Clause Granted Cambridge Company in Lieu of Flat Rate Increase.—Refusing the application of the Cambridge Electric Light Company for an increase in its maximum commercial rate from 9 cents to 12 cents a kilowatt-hour, the Massachusetts Department of Public Utilities permitted a surcharge of 1 cent a kilowatt-hour as well as a six-month fuel clause establishing an increase of 1¼ mills a kilowatt-hour for each dollar's excess in price of coal over the rate of $5 a ton. "It seems fair," the decision said, "that the customers paying the maximum price should have the same treatment as the other customers, namely, a 1-cent surcharge and the fuel clause. If, as was urged, a reduction in coal prices is imminent, this charge for the excess coal cost above the pre-war normal will eliminate itself as fast as that desirable objective is attained, and the surcharge also should be eliminated as soon as this can be prudently done."

Claim that Losses Give "Business Value" Called Absurd.—According to a decision by the California Railroad Commission the sum of $14,000 is "just compensation" for the light and power utility which distributes electricity in the city of Banning. The appraisal was made on request of the city, which has in contemplation the purchase of the plant. The commission refused to allow the plant owners a value of $2,000 claimed for the franchise under which the utility was operating and also disallowed a claim of $5,000 made by the company as the value of the business. The claim for "business value" was based on the fact that the company had lost approximately $5,000 during its operation. Declaring this claim unsound in principle and in fact, the commission asserted that if it were allowed "there would follow this absurd result: The greater the losses incurred in a utility business the greater its value, and the less profitable the business the larger the 'just compensation' to the owner. The mere statement of such a theory proves its absurdity."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Surrender of Franchise Involves No Surrender of Other Rights.—An electric service company surrendering its franchise and operating under an indeterminate permit does not, the Supreme Court of Indiana has found in Valparaiso Lighting Company vs. Public Service Commission, surrender any other of its property, as, for instance, its property right in a contract of a power company to furnish it electrical energy, entered into before the enactment of the public service law. A favorable long-time contract of this nature is to be considered like the company's other property in fixing rates to consumers. (129 N. E. 13.)*

Valuation on Five-Year Basis Prior to 1916 Improper.—The Supreme Court of New Jersey has found, in Elizabethtown Gas Light Company vs. Board of Public Utility Commissioners, that in valuing the company's property for the purpose of fixing rates it was unjust for the Board of Public Utility Commissioners to adopt as a standard the average prices prevailing for five years preceding Jan. 1, 1916, instead of allowing for the greatly increased prices at the time to which the rates apply. Allowance should also have been made for the increase in rates of interest on securities; nor was it proper to take the par value of the stock and outstanding bonds as the measure of invested capital where the investment had been built up through many years of successful management by reinvestment of income. (111 At. 729.)

New York State Tax as It Affects Outside Utilities.—The Court of Appeals of New York has reversed the trial court and sustained the Manila Electric Railroad & Lighting Corporation in its appeal from a decision obliging it to pay a license and franchise tax under the New York laws. A foreign corporation, the Court of Appeals holds, to be subject to such taxes must carry on its business in the state and also employ capital within the state, it being necessary that both conditions concurrently exist. When a foreign corporation had no property in the state other than bonds and notes deposited with a trust company as trustee and balance on bank account, and confined its operations in the state to collections and distribution to its stockholders of income from stock and obligations of other foreign corporations, it was not required to pay a license fee or franchise tax. (128 N. E. 892.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

John L. Ganz, electrical engineer, mechanical engineer and lawyer of St. Louis, has been elected treasurer of the Union Electric Light & Power Company of that city. Mr. Ganz was born

J. L. GANZ

in 1884 in Sprague, Mo. He taught school for two years after his graduation from high school and then for four years took a course in mechanical engineering at the Oklahoma Agricultural and Military College and an electrical engineering course at the University of Missouri. In the summer of 1906 he entered the motor and transformer department of the Union Electric Company and in a few years was made machine-shop foreman in charge of mechanical repairs. While holding this position he entered the Benton College of Law of St. Louis, from which he was graduated with the degree of LL.B. in 1916. On Feb. 1, 1917, a few months after he was admitted to the bar, he was appointed claim attorney for his company, and since Nov. 1, 1920, he has been the company's financial officer.

F. A. Williams has been elected chairman of the Public Service Commission of Oregon, succeeding Fred G. Buchtel.

Frank J. Duffy, president of the Southern Railway & Light Company, Natchez, Miss., has been elected chairman of the Board of Water Commissioners of that city.

A. B. Coryell has been appointed superintendent of power of the Laurel (Miss.) Light & Power Company. Mr. Coryell was formerly connected with the Burke-Fowler Electric Company, Alma, Mich.

Eckley Markle, Hazleton, Pa., has been appointed assistant general manager of the Wilkes-Barre & Hazleton Railway Company and the Lehigh Traction Company, Hazleton.

Dr. Louis Bell, consulting electrical engineer, Boston, who has been confined to his home by an attack of pneumonia, is now convalescing. His many friends will be glad to know that he will soon be at his office again.

Harry C. Stevenson has been appointed assistant to President Thomas N. McCarter of the Public Service Corporation of New Jersey and will act as Mr. McCarter's personal representative in the southern division of the territory served by the company's electric, gas and railway properties. He will make his headquarters in Camden. Mr. Stevenson has been connected with the Public Service Corporation of New Jersey ever since its organization in 1903. He began his career in the public utility field in 1897, when he became secretary to the late Thomas C. Barr, then president of the Worcester Traction Company. Later he served as auditor of the Elizabeth, Plainfield & Central Jersey Railway, becoming connected with the Public Service Corporation of New Jersey when the Elizabeth, Plainfield & Central Jersey was absorbed. After serving in a secretarial capacity to several executive officers

H. C. STEVENSON

Mr. Stevenson was, in June, 1907, made assistant secretary of the Public Service Corporation and of its underlying companies. In April, 1917, he was made assistant to Vice-president Edmund W. Wakelee.

H. J. Moulton, who has been assistant district manager of the Southern California Edison Company at Redondo, has been transferred to the position of district manager at Redlands.

Adam Gschwindt, vice-president and general manager of the Rockford (Ill.) Electric Company, was elected president of the Illinois State Electric Association at its recent annual meeting. His connection with the public utility field dates back to 1898, when he became associated with the Economy Light, Heat & Power Company of Scranton, Pa. Since that time Mr. Gschwindt has been superintendent of the steam-heating department of the

ADAM GSCHWINDT

Scranton Electric Company and vice-president and purchasing agent of the American Gas & Electric Company in New York City. He went to the Rockford Electric Company in 1913 in his present capacity of vice-president and general manager.

A. U. Brandt, who until recently held the position of superintendent of electrical distribution in Alameda County with the Pacific Gas & Electric Company of California, has been promoted to the position of electrical engineer of the San Francisco division of that company and will be in charge of the operation and maintenance of the electrical properties and steam generating stations in San Francisco. Although a native of Missouri, where he was born in 1877, Mr. Brandt has gained his electrical experience in California, to which state he went immediately after graduation from the University of Missouri in 1899. From then until 1904 he was an inspector for the Independent Electric Light & Power Company of San Francisco. When that company was purchased by the San Francisco Gas & Electric Company he became an inspector for the California Gas & Electric Corporation of Oakland. After the absorption, in 1905, of the latter company into the present Pacific Gas & Electric Company he filled various successive positions leading up to that of superintendent.

Irwin L. Moore, who has been appointed engineer in charge of special work of the New England Power Company at Worcester, Mass., is the son of General Manager Samuel C. Moore. The younger Mr. Moore is a graduate of Harvard.

John R. Le Vally, formerly sales engineer in the Chicago office of the Locomotive Superheater Company, has been appointed district manager of its new office in Pittsburgh, Pa., which was opened on Jan. 1. Mr. Le Vally is a graduate of the Armour Institute of Technology and has had extensive experience in power-plant engineering

J. R. LE VALLY

and construction. Before becoming associated with the Locomotive Superheater Company he was superintendent of construction in power plants for the Union Stock Yards & Transit Company and the Produce Terminal Corporation, in charge of design, purchasing and erection of several large power stations. During the war Mr. Le Vally was an officer in the United States Navy, serving on the battleship Vermont and the United States transport Huron.

Charles Hackel, formerly connected with the Western Electric Company, New York, has been appointed chief engineer for the Trenton & Mercer County Traction Company, Trenton, N. J., to handle all matters pertaining to power-plant and electrical operations.

A. D. Bailey, chief engineer of stations No. 1 and 2 of the Commonwealth Edison Company, Chicago, has been appointed superintendent of generating stations. Mr. William Wardell succeeds A. D. Bailey as chief engineer of station No. 1, and William Weyker has been appointed chief engineer of station No. 2.

Henry T. Pierce, a transmission engineer, formerly of Worcester, has returned and re-entered the employ of the Power Construction Company, a subsidiary of the New England Power Company. Mr. Pierce has been away from Worcester about a year, having been with Colonel George W. Bunnell, formerly president of the Power Construction Company, in Santo Domingo, West Indies, where he was general manager of the Badahoma Company, sugar manufacturer.

George E. Sanford of the General Electric Company, West Lynn, Mass., has been elected president of the American Society of Safety Engineers.

C. W. Yerger has been appointed district manager of the Boston office of the Cutler-Hammer Manufacturing Company, Milwaukee.

Harry C. Newkirk, formerly Western district manager for L. K. Comstock & Company, has become vice-president and manager of the F. E. Newbery Electric Company, Chicago.

Arthur H. Abbott has been appointed New England representative of the Ohio Electric & Controller Company, Cleveland, with offices at 88 Broad Street, Boston.

Charles B. Hawley, formerly assistant hydraulic engineer for the Aluminum Company of America, Pittsburgh, has entered private engineering practice with offices at Washington.

Fred E. Schornstein, formerly manager of the Red Wing (Minn.) property of the Wisconsin-Minnesota Light & Power Company, has been transferred to the home office of the company at Eau Claire, Wis.

Ruddy Holterman, formerly sales manager of the Holabird Electrical Company, San Francisco, which was recently purchased by the Fobes Supply Company of Portland and Seattle, has been made manager of the new San Francisco office of the consolidated company.

John Tyrone Kelly of the staff of the Society for Electrical Development has resigned to take up the direction of the national publicity and advertising campaign of the National Prosperity Bureau, which was recently launched by representatives of twenty-four national business associations to stimulate a return to normal buying.

J. L. Finnicum has been appointed sales manager of the Thorardson Electric Manufacturing Company, Chicago. Mr. Finnicum was formerly connected with the Doubleday-Hill Electric Company, Pittsburgh, for eight years as salesman and in charge of the apparatus department. For the last two years he has been acting as district manager at Chicago for the Electric Products Company of Cleveland.

A. H. Griswold, formerly plant engineer for the Pacific Telephone & Telegraph Company, with headquarters in San Francisco, has been appointed assistant chief engineer of the International Western Electric Company, Inc., in New York. After his graduation from the University of Illinois in June, 1901, Mr. Griswold entered the engineering department of the Western Electric Company. In 1905 he became affiliated with the Pacific Telephone & Telegraph Company.

James R. Werth has been appointed commercial service manager of the West Penn Power Company, Pittsburgh.

Robert M. Eames, who was recently appointed general sales manager of the Bryant Electric Company, Bridgeport, Conn., succeeding Frank V. Burton, has been active in the sales organization of the Bryant Electric Company for fifteen years. For the last few years he has been its export manager.

E. M. Cutting, Western manager of the Edison Storage Battery Company at San Francisco, recently came East to take up the duties of assistant to the general manager, Frank D. Fagan.

E. M. CUTTING

For many years Mr. Cutting was signal supervisor on the Southern Pacific Company's lines in the Far West, and later he was appointed to the position of engineer of train lighting, heating and ventilation for the same company. In 1913 he accepted the position of Western manager of the Edison Storage Battery Company.

Obituary

Charles E. Chapin, president and treasurer of the Charles E. Chapin Company, New York, manufacturer of brushes for electrical machinery, died suddenly Jan. 29, of apoplexy, at his home in Greenwich, Conn. Mr. Chapin was born in Collinsville, Conn., in 1854.

Wilbert H. Doughty, formerly a member of the electrical contracting organization of the Doughty & Welch Electric Company, Inc., Fall River, Mass., died recently. Mr. Doughty was a native of Brunswick, Me., and for some time traveled in the interests of the Thomson-Houston Electric Company and the Thomson Electric Welding Company, with headquarters at Lynn, Mass. Later he was at the head of the motor department of the Fall River Electric Light Company. He retired from the Doughty & Welch company in the summer of 1920.

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

Further Signs of Business Improvement Seen in Municipal Borrowing

EVERY DAY there are signs pointing toward an improvement in the general business situation, and the most marked this week is the number of municipalities that are rushing into the market for money. Many of these demands, of course, are for short-term loans in anticipation of the payment of taxes. A very substantial number, however, are seeking large sums for a long time. In these cases money is to be spent for permanent improvement, the effect of which will naturally make itself felt in industry.

Road and highway work will be undertaken this spring in greater volume than before in years. Transportation is available, as is also labor, and costs are lower. In the South this work is already under way in numerous instances. In many of these cases it is not improbable that sums aggregating a large amount will be spent for lighting.

Anyhow it takes only a few such activities to start others.

Bare-Copper-Wire Trade Marking Time

WITH electrolytic copper still at the extraordinarily low figure of 12.75 cents delivered for prompt shipment, the market for bare copper wire remains quiet. Recently one or two producers have reported that sales showed a slight improvement over December's business, but general demand is light. Wire manufacturers apparently appreciate the unusual opportunity which is offered to buy and stock copper for their future needs at its present low figure. Some are actually doing this as a matter of fact, but several others assert they have not the money and are not able to carry interest charges on a tied-up investment such as a large stock of copper would represent.

Stocks of finished bare copper wire are inconsiderable. The declining market and the policy of drawing wire for each individual order has served to keep stocks low. But as current buying is mostly of the necessity class, such as for telephone repairs, deliveries are entirely favorable, ranging from about two to three weeks. There is considerable shopping practiced by consumers, as prices under competition are very often shaded. Some manufacturers will not quote a base price, but, from the quotations of others, from 15 cents to 16 cents would appear to be the market on bare copper wire. The price curve, viewed from its peak quotation, has presented a gradual downward curve, reductions being made as recently as the latter part of January.

Mill operations are on a curtailed basis, not so much in the actual number of hours that plants are running as in the amount of work that is accomplished. Wage reductions of about 10 per cent have been put into effect in a few instances, and working forces in some cases have been reduced too.

Hundred-Million Mark Passed for 1920 Electrical Exports

WITH the month of December turning in a record value of electrical exports amounting to $13,812,251, the year 1920 finished with a total value of these exports which hangs up an annual record of $102,618,508, a figure approximately 15 per cent higher than the previous high year on record—1919. This is nearly equal to the total of exports for the years 1917 and 1918 combined.

The month of December exceeded that of November by three and three-tenths million dollars, or 30 per cent, and exceeded December of a year ago by almost 110 per cent. During December, 1920, more generators, fans, insulated wire and cable, interior-wiring supplies, meters and measuring instruments, motors, telephone and miscellaneous equipment left the country than during any other month.

Special attention is focused on the 1920 increases over 1919 on certain items. Rheostats and controllers increased nearly 200 per cent, interior-wiring supplies 50 per cent, generators 40 per cent, transformers 30 per cent, motors, switches and accessories 25 per cent, and miscellaneous equipment 20 per cent.

While it is generally stated that the export market during the last few months of the past year was quite dull, and is still so, it is probable that a great part of the electrical exports billed at that time of the year—high as they were—were booked during midyear or earlier, and prices at midyear were about at their peak on most classes of apparatus and wiring supplies. But they were higher during the first half of 1920 than they were during 1919.

Exchange rates in most foreign countries are still quite unfavorable for purchasers in the American market, but many countries found it necessary to purchase in the American market because European manufacturers were not able to supply both their own and a foreign market. This condition during the latter half of 1920 was gradually being overcome, and England and Germany are now prominent factors in the electrical markets of the world.

The accompanying table is made up from figures compiled by the Bureau of Foreign and Domestic Commerce.

Articles	Dec., 1919	Dec., 1920	1913	1914	1915	1916	1917	1918	1919	1920
Batteries	$477,102	$649,769	$359,123	$635,522	$1,364,999	$2,025,250	$3,624,222	$3,178,437	$5,998,337	$6,633,542
Carbons	100,496	123,793	.....	.....	.....	.....	*736,717	1,600,920	1,391,765	1,477,831
Dynamos or generators	583,025	1,487,543	2,374,122	2,372,816	1,872,191	1,867,565	2,356,780	3,363,349	5,799,885	7,937,935
Fans	32,648	257,432	415,774	295,966	374,113	313,771	622,731	847,327	1,421,160	1,365,766
Heating and cooking apparatus	110,575	206,548	.....	.....	.....	.....	1,256,533	686,339	1,579,757	1,801,127
Insulated wire and cable	499,315	1,301,307	*1,256,865	1,321,451	2,761,609	4,943,577	7,187,951	5,604,114	8,815,212	8,178,539
Interior wiring supplies, including fixtures	245,434	442,129	*408,253	591,136	882,981	901,657	1,405,772	1,428,615	2,319,498	3,386,068
Arc lamps	1,088	2,893	134,053	42,782	23,968	15,467	16,418	14,139	16,893	26,717
Carbon-filament lamps	16,678	19,622	254,893	88,025	150,111	124,776	187,876	102,872	202,590	114,542
Metal-filament lamps	311,308	463,487	301,791	278,061	873,862	1,420,309	2,884,675	3,369,192	4,674,317	4,050,549
Magnetos, spark plugs, etc	232,762	314,185	.....	.....	.....	.....	*1,757,848	2,749,705	3,034,775	3,601,419
Meters and measuring instruments	227,955	332,314	.....	*157,386	657,129	884,241	1,213,278	1,887,925	2,891,307	2,676,548
Motors	778,039	1,702,846	4,886,508	3,300,839	3,279,174	4,932,831	6,484,972	8,225,197	10,635,476	13,263,657
Rheostats and controllers	35,836	81,569	.....	.....	.....	.....	*93,612	288,757	514,760	1,407,719
Switches and accessories	216,020	568,343	.....	.....	.....	.....	*1,025,003	2,195,300	3,564,772	4,438,709
Telegraph apparatus, including wireless	41,767	101,605	147,233	93,563	136,890	209,343	555,703	378,806	830,887	713,798
Telephones	330,223	544,068	1,659,326	1,251,788	910,562	1,813,969	2,212,237	2,687,483	3,783,398	3,898,987
Transformers	297,869	696,057	872,661	934,312	704,373	1,051,168	1,747,884	3,528,673	3,787,851	4,803,158
All others	2,127,070	4,516,741	15,126,761	8,599,468	10,316,548	19,740,151	21,107,867	17,845,376	27,827,071	32,841,897
Total	$6,665,660	$13,812,251	$28,197,363	$19,963,115	$24,308,510	$40,244,075	$55,478,079	$59,982,526	$89,089,711	$102,618,508

* Figures begin with July.

Maintenance Demand for Brushes Holding Well

WHILE the market for carbon brushes for strictly maintenance work is holding up about on a normal plane, buying for new motors and generators has fallen off. The curtailment of production in the automobile manufacturing field has reacted on the brush producer, since a large volume of brush business is done for the automobile trade. This, of course, releases production capacity for the making of brushes for the strictly electrical market, so that shipment is short.

Motor production in itself has suffered a recession, both in fractional sizes and in integral sizes for industrial work. There have been somewhat fewer brushes needed for maintenance also of the industrial sizes because of curtailed operation in the mills of many of the larger industries of the country.

These factors help shipments, one and two weeks being the average length of time quoted for the filling of orders, while other quotations will take up to six weeks. Where it is necessary to fill a rush order, a small quantity of brushes can be got out in two days. And this comes right down to what seems to be more and more of a tendency today. Too many of these rush orders for overnight shipment are coming in to the manufacturers. The practice seems to be developing into one of waiting until the last minute and then ordering only a minimum number of pieces. Traction companies are particularly in the limelight in this connection, and they are the consumers which heretofore have been noted for keeping good stocks of brushes—at least to cover all emergencies. Of course, the financial condition of most roads is such as to require the limiting of future buying, but it would seem that purchases could be kept out of the rush class for this type of maintenance material, which is bound to wear out. The reaction comes, of course, on the producing abilities of the manufacturer.

Although stocks of foreign brushes are kept in this country, there is little stocking done by domestic manufacturers because of the great number of sizes, qualities and duties required by motor and generator manufacturers. There seems to be no standardization of brushes, but the question of correct brush application to the needs of the machine is receiving much more attention than it has in the past. There is no evidence of a price change in this product for the near future.

Malleable Iron Castings in Easier Supply

THE supply of malleable iron, which six months ago was all the way from a year to half a year behind orders on hand, has eased up very materially. As regards new business the market is absolutely quiet, for little or nothing in this line is being bought at present. Those manufacturers specializing in supplying the automobile trade have probably been hardest hit by the slump in business, as the automobile industry was about the first to react to the general falling off of demand. The previous press of orders for malleable castings had been so great, however, that some producers are only just now beginning to catch up on back orders.

Others who were perhaps quicker to feel the buying slump are at present working on a curtailed operating schedule that is down to three days a week in some instances. Wage reductions of 10 to 15 per cent and laying off of workmen have been quite numerous too. On the other hand, many malleable-iron factories have taken no steps in that direction.

Deliveries cover a wide range, dependent on the manufacturer and the type of casting. On the whole, the situation is favorable, because mills are now so situated that they can speed up if necessary. In order to keep the working forces intact and busy, however, there is probably a current tendency not to hurry on filling orders unless the need is urgent. This, as well as the large amount of pattern work required on certain material, may account for the extreme delivery period of two to three months that is quoted. From close to stock up to four or five weeks would seem to be a more representative figure. Stocks of finished material, as a matter of fact, virtually do not exist, as the unsteady market makes this inadvisable. For the same reason raw material is being bought in sparing quantities by some of the malleable castings makers.

Prices have trended downward following declines in fuel, pig iron and in some cases labor costs. The reductions made from peak prices average in several instances from 10 to 20 per cent. Further price developments, of course, depend upon the trend of the underlying markets, but according to one of the large companies in this field, which has already made two price reductions during January, the malleable-iron market has not yet touched bottom.

Cross-Arm Prices Show Reductions

CONDITIONS in cross-arm buying seem to be rather uneven. Price reductions of about 15 per cent, effective Feb. 1, are reported from the East and Middle West, but none is heard of from the South to date. Buying in the New York district is on a pretty fair basis, several satisfactory orders recently having been placed. Mid-West demand is only fair, while from the Atlanta territory the movement is quite slow. Stocks in jobbers' yards are reported good in all sections.

New prices for fir arms, two-pin, 3¼ in. x 4¼ in. x 3 ft., are quoted in New York at $61.13 per 100 in less than 1,000-lineal-ft. lots, and $54.34 in 1,000-ft. to 3,000-ft. lots. These in Chicago are $56.70 and $50.40. The N. E. L. A. fir arm, four-pin, 3¼ in. x 4¼ in. x 5 ft. 7 in., is quoted in New York at $138.26 and $122.91 and in Chicago $128.25 and $114, same quantities. The four-pin, 3¼-in. x 4¼-in. x 5-ft. arm is $90.56 in New York and $84 in Chicago, 1,000-ft. to 3,000-ft. lots.

From Atlanta, in lots of 1,000 lineal feet and over, two-pin, 4-ft. fir arms are quoted at $62; four-pin, 5-ft. arms at $104; N. E. L. A. arms, two-pin, 3-ft., at $106, and four-pin, 5-ft., at $157.

The Metal Market Situation

BUSINESS in the domestic copper market continues on a low level. Consumers are apparently showing no buying interest, while on the other hand large producers exhibit no impatience to sell. The result is an *impasse*, so far as business goes, especially as the spurt in foreign buying that was reported two or three weeks ago seems to have petered out. Producers continue to hold immediate deliveries at 12.75 cents delivered, with ¼ cent more covering the first quarter, but this price is not received as smaller agencies are shading prices. In the outside market copper can be obtained at 12.75 cents per pound for prompt delivery, with a slightly higher quotation for futures.

Through the issuance of securities to the public, the Copper Export Association is planning a way to dispose of about 400,000,000 pounds of copper to foreign countries, principally European countries. If this plan goes through it is expected that the tone of the market will become much firmer and that domestic activity will take on new form.

NEW YORK METAL MARKET PRICES

	—Jan. 25, 1921—	—Feb. 1, 1921—
Copper	£ s d	£ s d
London, standard spot	67 0 0	69 10 0
	Cents per Pound	Cents per Pound
Prime Lake	13.50	13.25
Electrolytic	12.75	12.75
Casting	12.50	12.37½
Wire base	15.75	15.75
Lead, trust price	4.75	4.75
Antimony	5.37½	5.25
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	11.50	11.50
Zinc, spot	5.80	5.50
Tin	32.75	33.00
Aluminum, 98 to 99 per cent.	28.30	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	6.00– 6.50	6.00– 6.50
Brass, light	4.00– 4.50	4.00– 4.50
Lead, heavy	3.75– 4.00	4.00– 4.25
Zinc, old scrap	3.00– 3.25	3.00– 3.25

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

IN NEW ENGLAND, the Southeast, the Atlantic States and the Northwest there is apparent a slight upward turn in the electrical business. Textiles and leather have opened up in New England and cottonseed-oil mills in the South, while building has started in the Northwest. The volume of business is still much below normal, but a definite trend is noticeable. The Middle West is quite inactive. The Northwest shows the greatest come-back in residence construction, other sections being quiet. Inquiries, though, feeling for prices, are quite in evidence.

Money is reported tight in the mountain regions—not that it flows easily anywhere just now—and collections are still requiring constant attention.

Stocks are ample for all present needs, and although the trade in general is looking forward to an active spring season it is not buying ahead to meet that condition as things stand at present.

Non-employment is on the increase, and shorter hours and lower wage scales are becoming more prevalent.

NEW YORK

There seems to be a division in the trade this week as to whether the turn of the tide has come which will lead to better business from now on. At least three houses besides those reported last week state that they have noticed a little better tone, a slightly improved volume of sales over the whole line of electrical material recently. On the other hand, three other houses of equal standing report that conditions are absolutely no better as far as they are concerned. Additional evidence from one of the largest electrical jobbers in the country who last week said general conditions showed improvement shows that this view was prematurely based on temporary evidence.

Regardless of the pros and cons of the situation the very fact that even a few jobbers are increasing their sales—and at least two local houses went ahead of December business in their January sales—is cause for encouragement. The trade is not allowing an optimistic feeling to overcome a sense of business caution, however, for at the present time there is hardly a dollar's worth of material on outstanding order. Despite that shelves are well filled with every line of material, and no difficulty is experienced in obtaining any goods immediately. Prices remain steady except for an increase in wiring porcelain from one source.

Conduit.—Demand is light, the few sales that are made being in small lots. Stocks are well filled in all sizes. In lots of 2,500 ft. ½-in. black is quoted from $70 to $79 per 1,000 ft., and ¾ in. from $93 to $105.

Locknuts, Washers and Bushings.—Sales are light, about on the same level as conduit, and the supply is adequate. Jobbers' discount in lots of 1,000 ranges from 50 to 60 per cent.

Rubber-Covered Wire.—Jobbers are selling in small quantity, but the general demand remains as light as heretofore. Stocks in many cases are held down to normal but in others are too large. Nominal quotations by jobbers on No. 14, in lots of 10,000 ft., range from $7.75 to $9.

Schedule Material.—The bottom seems to have dropped out of this market in so far as demand reported by jobbers goes. Efforts are devoted to keeping down stocks in this line. In some cases these are successful, in others far from successful. Prices are whatever can be obtained.

Non-Metallic Flexible Conduit.—Little or no call exists for loom, and stocks in this line too cannot be too small to suit jobbers. In 1,000-ft. lots the ⅜-in. size is quoted at from $25 to $30 and ½-in. from $27.50 to $32 per 1,000 ft., though lower prices than these have been obtained.

Knife Switches.—Very few are carried in stock, as virtually no demand is felt at present. One representative product in the single-throw, double-pole, 30-amp., 250-volt size is quoted at $1.76 with fuse in lots of twelve, and another make at $1.06.

Flexible Armored Conductor.—The supply is more than adequate to meet the extremely slow demand. The market for No. 14 two-wire, double-strip ranges from $63 to $65 per 1,000 ft. in quantities of 1,000 ft., although one large house has quoted as low as $55, which is below most manufacturers' prices.

Dry Cells.—"Necessity" buying accounts for a fair volume of sales, but otherwise demand is not large and the supply is plentiful. There seems to be a strong feeling in the trade that prices of batteries, in view of lower material costs, should drop. No. 6 in barrel lots is worth 36 cents.

Bells and Buzzers.—Although jobbers in this territory are making no sales and hold small stocks several manufacturers still report back orders for as long a period as three months. This demand has in large part come from other sections. Manufacturers' stocks as yet do not exist, but the shortage of castings and steel tops has been relieved and supplies should now accumulate in anticipation of a return of building.

Porcelain. — The American Jobbers' Supply Company, Woolworth Building, New York City, announces an increase in price of knobs, tubes and cleats, effective Jan. 18. The increase amounts to about 10 per cent.

CHICAGO

The business revival which seemed to be promised by the increase in the number of inquiries received a few weeks ago has not occurred. These inquiries, while still numerous, seem to be more in the nature of gathering information than of placing business. In the construction field it is known that many prospective builders are systematically calling for figures every few weeks, with the avowed intention of watching the market and taking advantage of the first real drop. Machinery dealers report that certain railroads have announced that they definately want to buy certain equipment but that they will place no orders until a price revision occurs. Just how far similar ideas are governing the electrical goods buyer is problematical.

All elements of the trade are showing increased sales activity, and contractor-dealers report their expectation of heavy business in the spring. This is dependent entirely on the trend of building material prices in general, as it seems beyond doubt that no great building progress can be made until brick, cement, aggregate, etc., follow the price trend indicated by lumber.

Motors.—No activity is reported, even the volume of inquiries noted a short time ago having fallen off. Stocks are accumulating and the volume of orders on file is steadily decreasing. Price lists are held firm, but some cutting on the part of overstocked dealers is reported and is having a demoralizing effect.

Control.—A comfortable amount of business is still being done on back orders, but the volume of new orders is below manufacturers' capacity. No change in price has occurred, and the cutting noted in the motor trade is not in evidence.

Transformers.—This business continues unchanged, although some inquiries are noted for transformers for farm-line service. The gradual steady movement of crops to market in the Central West is relieving financial conditions in that territory and restoring to the agricultural interests a portion of their buying power.

Copper Wire.—Business is good. Weatherproof is quoted on a 20-cent base, which makes No. 6 triple-braid, in 500-lb. lots, 21 cents and No. 8, 21½ cents per pound. Bare copper varies in price with different suppliers, an 18-cent base being a fair reflection of present average price.

Poles.—No change in price is reported, nor, according to producers, is any in sight. Current reports are to the effect that production costs are being reduced.

Insulators.—Absolute inability to catch up with demand is reported, deliveries on heavy types still ranging upward of four months. Prices are firm on the high level and demand continues insistent.

Heating Appliances.—Price list No. 25 of the Hughes line, effective Jan. 15, quotes a three-burner range at $150 in the plain finish. This amounts to about a 10 per cent reduction. Similar price revisions are shown on most items of the line. Sales of this class of material are reported as slow.

BOSTON

Business is spotty in New England electrical circles. Jobbers report well-distributed buying except from Boston contractor-dealers, whose affairs are disturbed by the strike in the building trades. Prices show little change compared with last week, although some weakness in retail prices is noted under sharp competition to move stocks. Collections are still slow and require close observation. Central stations appear to be developing more inquiries, and industrial buying is rather better, at least in the textile and leather industries. Conditions have been much improved in textile circles by the resumption of production accompanied by lowered wage scales. Jobbers' stocks are well filled in practically all staple lines, and deliveries are excellent with few exceptions.

Motors.—Local stocks are better than for some time, although some gaps exist in starting equipment, bases and pulleys. Prices are firm. Back orders still occupy manufacturers. On three-phase motors, which cannot be shipped from stock for one reason or another, deliveries of ten to sixteen weeks were being quoted Monday by a leading producer. A few motors as large as 100 hp. were reported in local stocks the first of the week, and earlier shortages of small integral horsepower motors had been largely overcome.

Wire.—Good sales of weatherproof are noted since the year began. In 5,000-ft. lots No. 6 is selling for 18 cents per pound. Rubber-covered wire is moving slowly at $8 per 1,000 ft. in 5,000-ft. lots. Bare base is about 17.5 cents. Stocks are ample.

Sockets.—A few are moving, but no serious drain on existing stocks appears.

Flexible Armored Conductor.—Moderate sales are being put through, No. 14 double-strip bringing $67 per 1,000 ft. in 1,000-ft. lots.

Porcelain.—Shipments have overcome recent low stocks. In barrel lots ⅝-in. x 3-in. tubes sell for $11.50 per 1,000 and "Nail-it" knobs for $27.50.

Magnet Wire.—Production has gained so much on orders that some new business can now be taken on. No surplus of magnitude has accumulated as yet and manufacturers appear actively occupied filling back orders.

Fans.—Some buying from manufacturers has begun, but the carry-over from last season has prevented heavy purchases so far in advance of the season. Fans will be purchased later on a quota basis in some cases, and one jobber who sold $87,000 worth last year and carried over but $1,500 worth will shortly canvass his dealers to get a line on this year's expectations. Prices remained firm up to the beginning of the week.

Rigid Conduit.—Local stocks are well supplied and no marked shortages are complained of. Prices Monday on the following sizes were: 1-in. black, $164.90 per 1,000 ft.; galvanized, $175.10; ¾-in. black, $84.15; galvanized, $89.25—all in less than 2,500-lb. lots.

Appliances.—Heaters and cleaners are moving slowly. Table appliances are rather quiet and washing machines in moderate demand.

Storage Batteries.—Within the last fortnight a better feeling has been noted in the automobile industry, and it is expected that this will soon be reflected in increased sales of battery equipment. Local stocks are in good shape, and deliveries to distributing depots for spring business are reported much better than last year.

ST. LOUIS

Inquiries have continued to be numerous during the past week, though there has been no improvement in actual sales noted to correspond to this. The attitude of business in general throughout this territory seems to be cheerful, and there is a great deal of construction work in contemplation for spring, but the tendency of the buyer to shop around and make five inquiries to one order shows that entire confidence in the stability of the market has not been established as yet. That practically all buying just at present is of the hand-to-mouth kind is shown by the number of orders billed during January by several jobbers. This approximately equals the number billed in January of last year, although the total volume of business will be greatly below that of the same period during 1920.

Jobbers' stocks of wiring and line materials are easily capable of taking care of the present demand but will fall short of meeting the requirements of the building program predicted for spring and summer. Jobbers are not increasing their stocks on this account, though, preferring to wait until that program materializes. Collections are averaging about sixty days with little hope of improvement in the near future.

Transformers.—Demand for both power and distribution transformers has slowed up considerably, and transformer manufacturers are making delivery out of stock on their regular sizes and types. Power transformers of the 66,000-volt types are being promised on four to five weeks' delivery, which is considered close to normal.

Tape.—Both the rubber and the black friction tape have been moving fairly well during the past week, but jobbers have more than enough to take care of the demand. The quotation on both is around 45 cents a pound in 100-lb. lots.

Wire.—Large stocks are still on the hands of St. Louis jobbers. Though practically no large orders are being placed there seems to be a steady volume of small sales of both rubber-covered and weatherproof. Quotations on No. 14 rubber-covered are hovering around $8.50 with occasional sales slightly below that figure. Weatherproof remains on the 22-cent base and bare on an 18-cent base. Demand for bare continues quiet.

Rigid Conduit.—Both black and galvanized are moving slowly, and jobbers' stocks are practically complete in view of the demand. A representative quotation is $77 per 1,000 ft., in 5,000-ft. lots, on the ¾-in. black.

Washing Machines.—Dealers report retail sales improving, though still far from good. There is no indication that manufacturers in this territory will readjust prices at present.

Non-Metallic Flexible Conduit.—Demand remains quiet and stocks continue large. The ½-in. conduit is quoted at $30 per 1,000 ft. and the $\frac{7}{32}$-in. at $27.50.

Schedule Material.—Stocks are large and sales continue small, though there have been quite a good number of inquiries made during the past week. Prices in general are firm.

Locust Pins.—Demand is spotty. The railroads are buying on a hand-to-mouth basis, and jobbers are finding it easy to supply their requirements out of stock. The 1¼-in. x 8-in. size pins are quoted around $30 per 1,000 in lots of 5,000.

ATLANTA

Reports throughout the district indicate a slow but nevertheless general revival of business activities, the most marked being in the industrial lines. Textile mills that have either been shut down or on part time are resuming operations on a normal basis with resultant decrease in non-employment. Cottonseed oil mills, many of which have been shut down since the Christmas holidays, are reopening and expect to keep in operation for several months to come.

Chattanooga reports 3,000 fewer unemployed there than on Jan. 1. Numbers of wage reductions by the textile trade are reported, while the Savannah Master Builders'

Association has followed the lead of the Atlanta branch and announced a general reduction in the building trades. The wage reduction proposed by the Atlanta, Birmingham & Alabama Railway, to become effective Feb. 1, has been ordered held up by the United States Labor Board, pending the filing of a petition by the railway company and a hearing upon it. This will cause a considerable postponement of an action that was being watched with interest by shipping and railway operatives throughout the United States. Except in the large centers, building has shown no sign of revival. The Southern Pine Association, 125 of the largest mills reporting, shows a reduction in the number of unfilled lumber orders of 1,000 cars since Jan. 1, with the mills operating at 50 per cent of their normal production.

Athens, Ga., suffered a disastrous fire in its business section last week, the greater portion of two blocks being destroyed and the damage being placed at between $2,000,000 and $3,000,000. Plans are already announced for the rebuilding of the devastated section. This, combined with rebuilding of other structures destroyed by fire—damage from fires in this section having shown an increase of approximately 40 per cent over December—will cause a revival in the demand for material entering into the building field.

Flexible Armored Conductor.—The market is very sluggish, heavy stocks being held by all jobbers. Price quoted on No. 14, two-wire, is $75 per 1,000 ft. with very few takers.

Fuses.—While a slump in demand is noted, the movement continues to hold steady with a reduced volume of orders. Stocks are reported in fair shape with the most active movement credited to the renewable type. No change in price is yet reported.

Safety Switches.—Requirements of the new code for safety switches on all approved installations have, of course, served to increase materially the demand in this line, and all popular sizes are reported active. Because of the anticipation of needs stocks are reported in good shape with shipments quite satisfactory. Price, two-pole, 3-amp., lots 20 to 100, $2.31 each.

Poles.—Jobbers report an increase in demand and anticipate still heavier movement within the next sixty days, the trade seeming to prefer the cedar to the chestnut variety. Stocks are in good shape, weather conditions having been favorable to good production. Prices, Western Red Cedar, f.o.b. Atlanta, 30-ft., 7-in. top, $20.05; 35-ft.. 7-in. top., $24.

SAN FRANCISCO

Heavy storms have done considerable damage in the state, but as far as can be ascertained they have not seriously affected the 1921 crops. For some months past the prospects for a record-breaking year for the power companies seemed unusually propitious, with much new power ready for distribution and with a fine snowfall in the mountains in frozen storage. Stock sales to the general public have been very encouraging, too. Now, however, the Great Western Power Company is threatened with a general strike of its linemen, who resent a wage reduction to $7 per day in place of $8 paid last year by that company only. The matter is now under discussion. The Pacific Gas & Electric Company's linemen are still receiving $7 and recently voted to continue on that basis.

Building has dropped during January, and most contractors are working about one-half their normal force. In fact, in certain Bay districts some contractors are contemplating the remodeling of their business along merchandising lines where their territories, chiefly containing bungalows, have been solidly built up and are now fixture and appliance territories instead. The general tone of the market is rather pessimistic on the part of the dealer and cautious on the part of the consumer. The retrenchments of the latter and a general belief in substantial price slashing are reflected in the hand-to-mouth buying of the farmer.

Alameda, across the bay from San Francisco, has been officially named as the site for the twenty-five-million-dollar United States naval base. It is stated, though, that the present huge Mare Island establishment will not be abandoned but maintained as a supplementary resource. Destroyer and submarine bases in San Diego are also recommended.

SEATTLE—PORTLAND

Building in Seattle since the first of the year has shown steady improvement, and from present indications operations will be in force much earlier than originally anticipated. The recent action of the master builders' association in reducing wages in the structural game 20 per cent, effective Feb. 1, coupled with a reduction in cost of lumber and other building materials, assures a considerable amount of building for this section this year; in fact, some really optimistic authorities assert that $35,000,000 worth of new construction will now proceed.

Electrical jobbers in both Seattle and Portland territories report that business is picking up slightly and that there is a downward trend in prices in certain lines. Collections are reported in rather poor shape, and some dealers in the country districts find this particularly so. It is certain that within sixty days, unless conditions improve amazingly, there will be many liquidations among the smaller dealers. However, this is not expected to interfere seriously with business generally throughout this section. The average period of collections ranges from forty-five to sixty days. Dealers and contractors state that business is holding up well, and contractors, particularly in the Seattle district, report a gradual improvement and a considerable amount of new work in prospect for the immediate future.

Portland district states that a very large number of permits for residences have been taken out since the first of the year, indicating a large building program during 1921. Manufacturers in this section report very little change in business, although the future looks promising. Stocks are gradually improving.

Schedule Material.—On account of an increasing amount of new construction since the first of year in Puget Sound districts, this merchandise is moving nicely. Stocks of sockets, switches, cutouts, etc., are in good shape, but some sizes of fuses are hard to get in package quantities.

Domestic Appliances.—In Seattle and Puget Sound cities the movement of washing and ironing machines and vacuum cleaners has dropped off noticeably, awaiting lower prices. Stocks are in fine condition.

SALT LAKE CITY—DENVER

Collections continue slow throughout the entire Rocky Mountain region. Banks are still reluctant about granting loans and in many cases are not able to handle paper even if they were so disposed. Lack of confidence in banking institutions, with no tangible reason, is handicapping business. In some quarters it is believed that many farmers are hoarding their money rather than risk it in the safekeeping of banks. This, of course, keeps much needed capital out of circulation and retards the return to normal merchandising.

Few building permits are being applied for and little or no construction is under way. A falling market in building materials, however, should act as a decided impetus when spring has arrived. Real estate firms are doing everything possible to launch a building boom and declare that indications point to gratifying activity within a few months. Meanwhile electrical dealers are getting prepared in the way of stocking with house-wiring materials. The general market condition is satisfactory, and slow but certain improvement is noted. A conservative estimate puts trade on a 65 per cent normal basis with a tendency to growing volume.

Portable Lamps.—There is a general tendency toward overstocks. The variety of designs and grades is almost endless. There are sales advertised on every hand.

Appliances.—These are moving generally with only fair success.

Lamps.—"Fill-your-sockets" campaigns are now on and meeting with satisfactory success. Where dealers have employed Boy Scouts to make a house-to-house canvass the returns have been good.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Wire Company Purchases New Plant

The Acorn Insulated Wire Company, 73 Richards Street, Brooklyn, N. Y., has acquired the plant of the Davis Oil Company on Ninth Street, extending to the Gowanus Basin bulkhead, for a new plant for the manufacture of insulated wire and other products. The property is 146 ft. x 380 ft., improved with five-story buildings, and has been held at about $150,000.

Technical Book Publisher Moves to New Quarters

The McGraw-Hill Book Company has just removed from its old quarters at 239 West Thirty-ninth Street, New York City, to 370 Seventh Avenue. The company occupies the entire tenth floor of the new Penn Terminal Building, extending from Thirtieth to Thirty-first Street, with floor space of 20,000 sq.ft. This is the third home of the book company since its organization in 1909, the two former homes having been in different spaces of the Thirty-ninth Street building.

New York Jobber Opens New Branch

The Royal-Eastern Electrical Supply Company, 114-116 West Twenty-seventh Street, New York City, distributer of General Electric Company's products, announces the opening of another new branch house, this one at 382 Jackson Avenue, Long Island City, where a complete line of electrical supplies and "Edison Mazda" lamps will be carried. The building is 25 ft. x 100 ft. and is of one-story-and-basement construction. The change took place Feb. 1, with George Young in charge.

Westinghouse Forms Illuminating Engineering Bureau

A new branch of technical service, the illuminating engineering bureau of the Westinghouse companies, has recently been created to assist Westinghouse interests and their field representatives in the application and sale of lamps, industrial lighting fixtures and lighting appliances. The work of the bureau will embrace the preparation of complete specifications on industrial, commercial, residential and street lighting, the preparation of technical articles and lectures, the testing and development of new accessories and the co-operative activities of engineering societies.

District illuminating engineers and lighting specialists have been appointed to work with the company's lighting salesmen. Headquarters of the bureau will be located at the lamp company's works in Bloomfield, N. J., under the general supervision of the lighting service department of the lamp company. A branch will be established at the George Cutter works of the Westinghouse Electric & Manufacturing Company in South Bend, Ind. S. G. Hibben at Bloomfield will direct the general operations of the lamp company district engineers and the bureau, while C. J. Stahl in South Bend will direct the Cutter specialists.

General Electric Reduces Wages

In line with the tendency of readjustments in wage scales to become more prevalent throughout industry as a whole, the General Electric Company has made downward revisions in the pay of day workers in its Schenectady works of 10 per cent and of piece workers of 15 per cent, effective Feb. 1. The weekly bonus will also be dropped. Wage adjustments have also been made at the Lynn, Sprague and other apparatus and supply plants of the company.

At the same time reductions have been made in some of the lines of apparatus and supplies manufactured by the company.

Western Appliance Building New Plant

The new factory of the Western Appliance Manufacturing Company, which will be located at 5623 Duwamish Avenue, Seattle, Wash., is well under way and its completion is expected very shortly. It will embrace 10,000 sq.ft. of floor space and will be modern in every respect, the daylight feature especially being stressed. In the one and one-half stories, in addition to space for manufacturing 500 "Mercer" ironing machines a month, there will be a gymnasium and a swimming pool.

Insulator Manufacturer Doubles Capacity

The Jeffery-Dewitt Insulator Company, Huntington, W. Va., has just put into operation a new kiln which with its supporting accessories will double the insulator capacity of the plant. In addition, in order to have a continuous source of raw material and to be independent of the market for feldspar, the company has purchased its own feldspar mine.

Fan Manufacturer Occupies New Office Building

Removal is announced of the executive offices of the Robbins & Myers Company, Springfield, Ohio, from plant one to a new concrete and steel building. This has a total of 42,000 sq.ft. of floor space embraced in its four floors and houses about 300 people, taking in the purchasing, cost, mailing, telephone, fan and motor sales, advertising, factory auditing and accounting departments and the general officers.

Philadelphia Jobber Expands Facilities

The Schimmel Electric Supply Company, now at 318 Market Street, Philadelphia, has purchased the building at 526 Arch Street. It is a six-story building, 30 ft. x 200 ft., and together with the basement has a floor space of 42,000 sq.ft. After extensive alterations the building will be equipped as a wholesale electrical supply house, with all the modern facilities to take care of the expansion of the company, according to Mr. Schimmel, who states his belief that the business world is rapidly readjusting itself and that a wave of prosperity is on the way.

New Name for Power-Plant-Equipment Representative

The Great Western Contracting Company, Kansas City, Mo., has changed its name to the Rawlings Industrial Equipment Company. The company is sales engineer for manufacturers of power-plant machinery, representing the Conveyors' Corporation of America, the Springfield Boiler Company and the Cooling Tower Company.

Atlas Valve Acquires Automatic Pump Governor Rights

An announcement from the Atlas Valve Company, 282 South Street, Newark, N. J., is to the effect that the company has acquired by purchase from the Ideal Automatic Manufacturing Company the sole patents and rights to manufacture the Ideal automatic pump governor. This rounds out the company's line of valves, pump governors, regulators, etc.

San Francisco Electrical Jobber Changes Ownership

The Fobes Supply Company of San Francisco has purchased the Holabird Electric Company of that city, and the consolidated organization will continue under the name of the Fobes Supply Company. The Fobes company has also establishments in Portland, Ore., and Seattle, Wash. The San Francisco organization will be a separate corporation, although F. N. Averill is president of all the three companies. R. S. Holterman, formerly sales manager of the Holabird Electric Company, has been appointed manager of the new organization, with headquarters at 523 Mission Street, San Francisco.

Heating Equipment Production Changes Hands

The Dalton-Marsh Company, Danvers, Mass., has been organized to continue the business formerly conducted under the name of the William H. Dalton Company, manufacturer of specialized electric heating equipment, Salem, Mass.

Material Handling Developments

The Conant Machine Company, Concord Junction, Mass., manufacturer of motor-driven coal loaders, has established a selling arrangement with the Fairbanks Company for the marketing of its machines. The Conant company is about to issue a new catalog and is now developing a new line of screening and elevating plants for gravel and crushed stone service, with electric drive.

St. Louis Brass Expands

The St. Louis Brass Company, St. Louis, Mo., manufacturer of "Brascolite" lighting equipment, has announced the completion of a new factory. The new building adjoins the old factory on Washington Avenue near Jefferson Avenue and has a floor area of 75,000 sq.ft., giving the company a total factory space of 125,000 sq.ft. The structure just completed is five stories high and is built of concrete, brick and steel. It is the third addition to be made since the incorporation of the company in 1902, almost all the factory space at present being devoted to the manufacture of lighting units and equipment.

The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, has acquired property near its present plant which will be used later for extensions.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., announces the opening of a new branch office and service station at 75 Fremont Street, San Francisco. This office will have jurisdiction over the entire Pacific Coast territory and will be in charge of M. A. Johnson. At this address there will be a complete stock of parts carried and a factory-trained mechanic will be on hand.

The Ambrevo Electric Company, Chicago, manufacturer of electrical specialties, has filed notice of increase in capital stock from $20,000 to $150,000.

The J. J. Ross Engineering Company, 1006 Larned Street, East Detroit, Mich., manufacturer of battery-charging apparatus, is enlarging its plant.

The Edward R. Ladew Company, Inc., New York City, tanner and leather-belt manufacturer, has closed its sales office at Charlotte, N. C., and has transferred its Southern headquarters to 95 South Forsyth Street, Atlanta, Ga. An ample stock of belting and leather specialties will be carried.

The Watson Elevator Company, 407 West Thirty-sixth Street, New York City, has leased the adjoining building, which it will use for proposed extensions.

The R. W. Lillie Corporation, 30 Church Street, New York City, has taken on representation of the line of externally operated switches manufactured by the Wadsworth Electric & Manufacturing Company, Covington, Ky., for the territory covered by the Atlantic seaboard.

The Majestic Electric Development Company, San Francisco, at its annual stockholders' meeting on Jan. 15 re-elected the former directors, and the board of directors subsequently re-elected the previous officers of the company.

A. H. Lyons & Company, Stephen Girard Building, Philadelphia, has been reorganized under the name of the Lyons Storage Battery Company, Inc.

The Apex Electrical Distributing Company, Cleveland, has removed its Atlanta (Ga.) office from the Candler Annex Building to the Walton Building.

The Burke Electric Company, Erie, Pa., contemplates erecting an addition to its plant to cost about $28,000.

The Continental Radio & Electric Company, 6 Warren Street, New York City, is considering increasing its capital stock from $30,000 to $60,000.

The American Insulated Wire & Cable Company, Chicago, has recently purchased a one-story building at Twenty-second and Fisk Streets, containing 40,000 sq.ft., which will be remodeled and used as a copper-wire rod mill. New equipment to cost about $200,000 will be installed.

Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, held its annual dinner at the La Salle Hotel Jan. 5, which was attended by the officers and directors. Each department in the office and factory was also represented by at least one employee, those present numbering forty-six. W. R. Abbott, vice-president of the Illinois Bell Telephone Company and a director of the Beardslee company, gave an address.

The Electro Service Company, Marietta, Ga., manufacturer of surge arresters, has recently appointed the following sales representatives: The R. W. Lillie Corporation, 176 Federal Street, Boston, and 30 Church Street, New York City, to cover the territory in New England and the upper part of New York State; the W. D. Hendry Company, Hoge Building, Seattle, to represent the company in the States of Washington and Oregon, British Columbia and Alaska; Jones & Hitchin, Lonja del Comercio 216, Havana, Cuba.

The Independent Wireless Telegraph Company, 42 Broadway, New York City, has increased its capital stock to $500,000.

The Electric Storage Battery Company, Allegheny and Nineteenth Streets, Philadelphia, has filed plans for the construction of a two-story building to be used for welfare work for employes.

The American Steel & Wire Company, Chicago, is planning to build a three-story addition to its plant in Worcester, to cost about $150,000.

William S. Higbie, electrical engineer, 114 Liberty Street, New York City, has established an inspection and purchasing service for buyers of power equipment, with offices at the above address. Mr. Higbie was formerly with the Chile Exploration Company, New York City.

Market Data Book and Directory.—"Crain's Market Data Book and Directory of Class, Trade and Technical Publications" is the title of a reference book for advertisers published by G. D. Crain, Jr., 417 South Dearborn Street, Chicago. This is an annual reference book and contains the basic information regarding each trade, industry and profession. It also includes the field covered, the publications and closing dates, the type-page size and circulation.

The Alloy Metal Wire Company, 154 Nassau Street, New York City, has filed notice of increase in capital stock from $100,000 to $200,000.

The Troy Electrical Company, Troy, N. Y., has filed notice of increase in capital stock from $10,000 to $30,000.

The Porter Electric Company, Utica, N. Y., has filed notice of increase in capital stock from $20,000 to $100,000.

The Instantaneous Electric Heater Corporation, Root Building, Buffalo, recently organized with a capital stock of $500,000 to manufacture electric heating devices, has plans under way for the erection of a new plant, which will be equipped for a capacity of about 500 heaters per day. Arrangements have been made for a stock issue of $200,000, the proceeds to be used for construction of the proposed plant.

The Ajax Electric Specialty Company, St. Louis, Mo., has recently appointed nine sales representatives to distribute its products throughout the country, as follows: Clarence P. Denny, 524 First Avenue, South Seattle, Wash., will cover the territory in the States of Washington and Oregon; A. C. Riddell, Higgins Building, Los Angeles, and Marvin Building San Francisco, will cover California, Nevada, Arizona, New Mexico and the city of El Paso, Tex.; the Kiser, Ackermann, Gardner Company, Salt Lake City, will represent the company in Utah, Idaho, Montana and Wyoming; the Kirtz-Bruhm Company, Liberty Building, Buffalo, will cover New York State exclusive of New York City, the western part of Pennsylvania and the State of Ohio, exclusive of Cincinnati; the Electrical Sales Company, Kenyon Building, Louisville, Ky., will represent the company in Cincinnati and Louisville; the F. W. Oettinger Corporation, Grand Central Palace, New York City, will have charge of Philadelphia, Baltimore, Washington, D. C., and the New England States; O. T. Jenkins, 414 Dallas County Bank Building, Dallas, will handle Oklahoma, Texas, New Mexico and Shreveport, La.; Walter Ehamm, Hall Building, Kansas City, Mo., will have charge of Kansas, western Missouri, Iowa and Nebraska; J. A. Jacobsen, 17 North Wabash Avenue, Chicago, will represent the company in Chicago, northern Indiana and Wisconsin.

Foreign Trade Notes

ELECTRICAL SECTION, CANADIAN MANUFACTURERS' ASSOCIATION, MONTREAL.—An electrical manufacturers' section of the Montreal branch of the Canadian Manufacturers' Association was formed on Jan. 5 at a meeting in Montreal. The section is to consist of members engaged in the manufacture of electrical apparatus and equipment, at present members of the association, and such other manufacturers of electrical apparatus and equipment as in the future may become members of the association. M. K. Pike, sales manager of the Northern Electric Company, was elected chairman of the section, and R. Moncel, of the Devoe Electric Switch Company, vice-chairman.

THE MINIMAX ELECTRIC & MANUTURING COMPANY, 99 Bernard Lane, Maisonneuve, Quebec, Canada, has recently established a plant for the manufacture of high-power storage batteries for all purposes. The business is under the management of W. F. Cleaver, who has been connected with the industry for many years.

THE EUGENE F. PHILLIPS ELECTRICAL WORKS, LTD., Montreal, Canada, announces it will begin work at once on the construction of a copper-rod rolling mill to have a daily capacity of 100 tons. The plans provide for an extension for the rolling of copper sheets and the drawing of copper tubes as well as for the erection of a small refinery to take care of the copper scrap from the mill and also from a large wire and cable factory of the company. For the present the company will import electrolytic copper wire bars.

VICKERS, LTD., London, England, is opening a new sales office in Montreal, Canada, in charge of R. S. Griffiths, formerly of Barrow-in-Furness, England, who will have charge of the sale of Vickers' hydraulic turbines and governors, oil engines, etc., in Canada. These engines are manufactured in sizes from 2½ hp. to 450 hp., for both industrial and marine installations. Mr. Griffiths' temporary headquarters will be at the Place Viger Hotel, Montreal.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Baltimore, Md., has made arrangements with A. J. Hopkins, formerly with the Canadian Fairbanks-Morse Company and ex-chairman of the Canadian auxiliary of the Automotive Equipment Association, to act as its Canadian representative. Mr. Hopkins' headquarters are at 392 St. James Street, Montreal.

OPPORTUNITY FOR AMERICAN ELECTRICAL MANUFACTURERS IN FRANCE.—According to J. A. M. de Sanchez, director of the economic division of the French commission in the United States, a great opportunity exists for the American electrical goods manufacturer who wishes to export his products to France. This condition has been brought about by the recent efforts of the French government to develop water power throughout France, with the twofold object of conserving coal and supplying a cheap and permanent source of power. American goods, however, he declared, must be of the highest caliber and must be sold on a liberal payment basis.

GERMAN COMPANIES CONSOLIDATE.—Among the many consolidations reported to have taken place in Germany is a working agreement between the Vereinigte Lausitzer Glaswerke and the Siemens & Halske Electricitäts-Gesellschaft for the manufacture of electric bulbs. The glass works was taken at 750 marks per share.

INCREASE IN DEMAND FOR ELECTRICAL EQUIPMENT IN GUATEMALA.—Herndon W. Goforth, American Viceconsul at Guatemala City, reports that an increase in demand for electrical equipment of all kinds has been noticeable since April, 1920. Both electric generating plants in Guatemala City are being enlarged and the generating capacity increased by about 50 per cent, which will be available early in 1921. As soon as this additional power is added to the service a further increase in demand for electrical equipment is expected.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm of commission agents in India (No. 34,350) desires to get in touch with American firms for the importation of electrical goods, etc.

A commercial agent in Spain (No. 34,351) desires to secure the representation of firms for the advertising and organizing of sales offices for the sale of electric motors, cooking ranges and labor-saving devices of all kinds.

The engineer of a municipality in India (No. 34,378) desires to purchase three electric elevators for use in public buildings.

A mercantile firm in Spain (No. 34,333) desires to secure an agency and to purchase on its own account electrolytic copper wire from 1 mm. to 9 mm. dish-washing machines and laundry machines for family and hotel use.

A New Zealand purchasing agent (No. 33,334), who is at present in the United States, desires to secure agencies for electrical appliances, including electric household devices, etc.

New Apparatus and Publications

PORTABLE LAMPS.—Catalog No. 69 illustrates the portable lamps of the incandescent Supply Company, 636 Liberty Avenue, Pittsburgh.

METERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued publication 875 on the Thomas meter for measuring electrically large quantities of commercial gases and air.

ELECTRIC RIVET-HEATING FORGE.—The United States Electric Company, New London, Conn., has issued bulletin No. 5, on its electric rivet-heating forge.

TRANSFORMERS.—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued bulletin 124, covering its different types of transformers.

TRANSFORMERS.—The Esterline Company, Indianapolis, Ind., is distributing a four-page leaflet describing its new portable multi-range current transformers rated at from 25 amp. to 800 amp.

BATTERY CHARGERS.—The Acme Electric & Manufacturing Company, Cleveland, has issued a folder on its new "Acme Chargers for Industrial Vehicles."

WASHING MACHINES.—The Voss Brothers Manufacturing Company, Davenport, Iowa, has issued a booklet on its nine types of washing machines.

CONDULETS.—Crouse-Hinds Company, Syracuse, N. Y., has issued a folder illustrating actual condulet installations.

DIESEL ENGINES.—The Western Machinery Company, 900 North Main Street, Los Angeles, has issued a catalog describing and illustrating the "Western" Diesel engines, including stationary and marine types.

MAGNET CONTROLLER.—The Ohio Electric & Controller Company, Cleveland, is distributing a circular describing its new "Ohio" two-unit magnet switch magnet controller.

CIRCUIT BREAKER.—The new U-Re-Lite circuit breaker in capacities up to 60 amp. is described in a bulletin of the Cutter Company, Philadelphia, Pa.

APPARATUS FOR ELECTROMETRIC DETERMINATIONS.—The Pyroelectric Instrument Company, 636-640 East State Street, Trenton, N. J., has issued bulletin C-18, describing its apparatus for electrometric and colorimetric determinations of hydrogen ion concentrations.

BLOWERS.—The Electric Blower Company, 352 Atlantic Avenue, Boston, is distributing a six-page leaflet describing its different types of "Marvel" electric blowers, rivet forges, ventilating fans, etc.

MOTORS.—The Mechanical Appliance Company, Milwaukee, has issued bulletin 401, describing the Watson direct-current motors, and bulletin 402, covering the Watson alternating-current motors.

METAL.—"Monel Metal" is the title of a twenty-eight-page booklet published by the International Nickel Company, 43 Exchange Place, New York City.

INDUSTRIAL TRUCKS.—The Elwell-Parker Electric Company, Cleveland, is distributing two four-page leaflets, one describing electric trucks for use in paper mills and the other its malleable-iron pot truck.

FOUNDRY LADLES.—The Whiting Corporation, Harvey, Ill., has issued catalog No. 156, superseding No. 147, covering its foundry ladles.

New Incorporations

THE MID-STATE MANUFACTURING COMPANY, Oklahoma City, Okla., has been incorporated by A. F. Rueb, Oklahoma City; M. J. O'Connor and Ray Ransel both of Edmonds, Okla. The company is capitalized at $16,000.

THE E. M. FAY ELECTRICAL COMPANY, INC., Worcester, Mass., has been incorporated by E. Miller Fay, 10 Morningside Road, R. H. Fay and W. H. Stanton to manufacture electrical appliances and equipment. The company is capitalized at $100,000.

THE METROPOLITAN ELECTRIC SERVICE COMPANY, Oklahoma City, Okla., has been incorporated with a capital stock of $50,000 to manufacture electrical equipment. The incorporators are: Walter Hawkins, T. N. Wells and Cody Fowler.

THE ROCHESTER ELECTRIC SUN SIGNS, INC., Rochester, N. Y., has been chartered with a capital stock of $40,000 by B. M. Olcott, H. D. Gardiner and V. H. Clymer, Syracuse. The company proposes to manufacture electrically operated display signs.

THE C. & D. MANUFACTURING COMPANY, DETROIT, has been incorporated by A. B. Eggert, Ray J. Corrigan, 59 Glendale Avenue; G. T. DuBois and others. The company is capitalized at $50,000 and proposes to manufacture washing machines and other kinds of mechanical laundry equipment.

THE KNIGHT-CHASE COMPANY, Boston, Mass., has been incorporated with a capital stock of $20,000 by John Knight, 100 Queensbury Street, and others. The company proposes to manufacture electric flashing devices and other electrical appliances.

G. E. BLISS, INC., Malden, Mass., has been incorporated by G. E. Bliss, Lewis J. Sage and Chester T. Bliss, 80 Florence Street. The company is capitalized at $15,000 and proposes to manufacture electric heating appliances.

THE YARMOUTH ELECTRIC COMPANY, Augusta, Me., has been chartered with a capital stock of $25,000 to manufacture and deal in electrical products. The incorporators are Harold D. Jennings, Walter S. Wyman and E. A. Ballantyne.

THE BUFFALO ELECTRIC SUN SIGNS, INC., Buffalo, has been incorporated by B. M. Alcott, H. D. Gardner and V. H. Clymer, Syracuse, N. Y. The company is capitalized at $45,000 and proposes to manufacture electrically operated outdoor display signs.

THE KAHN HOLD-UP & BURGLAR ALARM CORPORATION, New York City, has been incorporated by M. Hirschman, M. and B. G. Kahn, 113 East Twenty-fourth Street. The company is capitalized at $100,000 and proposes to manufacture electrically operated alarm systems and equipment.

NORRIS BROTHERS, INC., Robinson, Ill., has been incorporated with a capital stock of $250,000 to manufacture machinery and parts, electrical appliances, etc. The incorporators are Daniel E., Frank H. and Paul E. Norris.

THE UNIVERSAL LAMP COMPANY, 329 Plymouth Court, Chicago, has been incorporated by Roderick H. O'Connor, William H. Gallaher and Charles J. O'Connor. The company is capitalized at $150,000 to manufacture electric lighting equipment, attachments and parts.

THE RENFRO-SMITH COMPANY, New York City, has been incorporated by H. S. Smith, J. F. Renfro and S. M. Cohen, 1834 Broadway, to manufacture motors and electrical products. The company is capitalized at $15,000.

THE MORRIS MANUFACTURING COMPANY, Philadelphia, has been incorporated by F. R. Hassell, J. Vernon Pimm and E. M. MacFarland. The company is capitalized at $100,000 and proposes to manufacture electric lamps and kindred specialties.

THE UNITED GAS & ELECTRICAL ENGINEERING COMPANY, 700 West Baltimore Street, Baltimore, has been incorporated by Philip Raun, Solomon Berkowich and Jesse Fine. The company is capitalized at $100,000 and proposes to manufacture lamps, electric and gas fixtures, etc.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 11, 1921)

1,365,269. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; Lipa Polinkowsky, N. Y. App. filed Feb. 6, 1919. Full automatic.

1,365,270. TELEPHONE-EXCHANGE SYSTEM; Lipa Polinkowsky, New York, N. Y. App. filed May 2, 1919. Machine switching.

1,365,285. BRUSH HOLDER FOR MAGNETIC CHUCKS; Frank L. Simmons, Woonsocket, R. I. App. filed Jan. 6, 1919. Contact members are covered.

1,365,292. METHOD OF MAKING CONDENSERS; Phillips Thomas, Edgewood Park, Pa. App. filed April 18, 1919.

1,365,302. DIRECT-CURRENT MOTOR; James Burke, Erie, Pa. App. filed March 14, 1917. For drills, etc.

1,365,305. SYSTEM OF ELECTRICAL DISTRIBUTION; William A. Darrah, Wilkinsburg, Pa. App. filed June 11, 1915. Electromotive forces of constant value continuously impressed upon translating devices.

1,365,311. ALTERNATING-CURRENT WELDING SYSTEM; Otto H. Eschholz, Wilkinsburg, Pa. App. filed June 25, 1919. No moving parts.

1,365,316. SYSTEM OF CONTROL; Arthur J. Hall, Wilkinsburg, Pa. App. filed Oct. 3, 1917. Automatic control of electric railway vehicle.

1,365,317. SYSTEM OF CONTROL; Arthur J. Hall, Pittsburgh, Pa. App. filed Feb. 25, 1919. Control of plurality of motors.

1,365,322. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed Dec. 2, 1918. Motor starter and controller.

1,365,323. CONTROL SYSTEM; Henry D. James, Edgewood Park, Pa. App. filed May 12, 1919. For controlling excitation during acceleration.

1,366,325. CONTROL APPARATUS; Howard H. Johnston, Edgewood Park, Pa. App. filed March 7, 1919. For preventing rapid movement of drum controller.

1,365,331. ELECTRIC RESISTANCE ELEMENT; Leon McCulloch, Wilkinsburg, Pa. App. filed June 8, 1916. Coated resistors.

1,365,332. ELECTROMAGNET; Benjamin McInnerney, Council Bluffs, Iowa. App. filed March 28, 1917. Noise reduced.

1,365,421. CONTROL APPARATUS; Thomas C. MacKau, Pittsburgh, Pa. App. filed June 9, 1919. Liquid-rheostat resistance varied by bubbles of air.

1,365,425. SOUNDPROOF SHIELD; Walter A. Shewhart, Brooklyn, N. Y. App. filed Dec. 26, 1919. Telephone.

1,365,441. SERIES-MULTIPLE CONTROL; Ernest F. W. Alexanderson, Schenectady, N. Y. App. filed Feb. 10, 1917. Operation of polyphase motors on single phase.

1,365,465. CABLE FOR THERMO-ELECTRIC CIRCUITS OF GRAIN TANKS; Leonard H. Des Isles, Chicago, Ill. App. filed July 24, 1918. Means for forming dead air spaces.

1,365,470. WAVE DISTRIBUTION; Henry C. Egerton, Passaic, N. J. App. filed July 26, 1917. Transmitting identical messages through a plurality of media.

1,365,481. RESISTANCE DEVICE; Emery G. Gilson, Schenectady, N. Y. App. filed April 23, 1920. With marked negative thermal coefficient of resistance.

1,365,491. ELECTRIC CONTACT DEVICE; Julius F. G. P. Harmann, Copenhagen, Denmark. App. filed April 20, 1920. For interrupters, commutators, regulating resistances, etc.

1,365,502. PREVENTION OF OBJECTIONABLE VOLTAGE FLUCTUATIONS ON DISTRIBUTING SYSTEMS; Arthur F. Knight, Schenectady, N. Y. App. filed Oct. 6, 1917. When putting load on or off.

1,365,505. AUTOMATIC REGULATING SYSTEM; Willem C. Korthals-Altes, Schenectady, N. Y. App. filed April 18, 1918. Motor controls excitation of dynamo by counter electromotive force.

1,365,519. ELECTRIC EDGE HEEL AND SHANK SETTER; William Lutes, San Antonio, Tex. App. filed Aug. 4, 1920. Applied upon ordinary shoe machinery.

1,365,544. CAR-LIGHTING SYSTEM; Harry D. Rohman, New York, N. Y. App. filed Oct. 1, 1918. For railway.

1,365,545. LIGHTING SYSTEM; Harry D. Rohman, New York, N. Y. App. filed Oct. 1, 1918. Lighting and heating railway vehicles.

1,365,554. RADIANT HEATING UNIT; Milton H. Shoenberg, San Francisco, Cal. App. filed Dec. 27, 1919. Element has improved shape.

1,365,566. AUTOMATIC REGULATING SYSTEM; Louis W. Thompson, Schenectady, N. Y. App. filed Oct. 25, 1919. Control by counter-electromotive force.

1,365,568. ELECTROMAGNETIC APPARATUS; Matthew O. Troy, Pittsfield, Mass. App. filed Feb. 3, 1919. Transformer core.

1,365,569. ELECTROMAGNETIC APPARATUS; Matthew O. Troy, Pittsfield, Mass. App. filed Feb. 3, 1919. Core parts.

1,365,576. RADIO-RECEIVING SYSTEM; William C. White, Schenectady, N. Y. App. filed Oct. 11, 1917. Electron discharge device.

1,365,579. RADIO APPARATUS; Thomas Appleby and Lloyd M. Knoll, Philadelphia, Pa. App. filed June 14, 1919. Transmitting and receiving apparatus.

1,365,585. SYSTEM OF CONTROL; Ralph E. Ferris, Edgewood Park, Pa. App. filed July 19, 1917. Regenerative operation.

1,365,636. ELECTRIC POCKET LAMP; Conrad Boltshauser, Roschach, Switzerland. App. filed July 6, 1920. Improved switch.

1,365,638. X-RAY APPARATUS; William D. Coolidge, Schenectady, N. Y. App. filed April 13, 1917. For inexperienced operator.

(Issued Jan. 18, 1921)

15,030 (reissue). INSULATED SUPPORT FOR ELECTRICAL CONDUCTORS; Louis Steinberger, Brooklyn, N. Y. App. filed June 1, 1920. Inductance coils in radio apparatus.

1,365,664. METHOD OF RIVETING AND APPARATUS THEREFOR; Harry B. Cox, Los Olivos, Cal. App. filed Oct. 8, 1917. Rivet rotated instead of hammered.

1,365,691. PHASE-CONVERTER BALANCING SYSTEM; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 28, 1917. Phases held in balance.

1,365,693. THERMOSTATIC BURGLAR-ALARM SYSTEM; Simon B. Hess, Jamaica, N. Y. App. filed April 8, 1918. For protection of banks, stores, etc.

1,365,700. IMPULSE-STARTER COUPLING FOR MAGNETOS; Victor W. Kliesrath, East Orange, N. J. App. filed May 31, 1919. Spring coupling.

1,365,724. ELECTRIC WINDING MECHANISM FOR SPRING MOTORS; James J. Phillips, Rochester, N. Y. App. filed June 2, 1917. For phonographs.

1,365,725. METER-TESTING SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed Nov. 17, 1919. Without interrupting service.

1,365,734. ELECTRON-TUBE-TESTING CIRCUITS; Samuel P. Shackleton, New York, N. Y. App. filed March 18, 1919. For determining current and voltage relations.

1,365,787. METHOD AND APPARATUS FOR WIRELESS SIGNALING; Fred H. Kroger, Brooklyn, N. Y. App. filed Aug. 2, 1915. Quenched spark gap.

1,365,801. BATTERY APPARATUS; Irving R. Solomon, Los Angeles, Cal. App. filed Sept. 11, 1918. For replenishing electrotype and testing level and gravity.

1,365,814. RECORDING LOCK; James W. Bryce, Binghamton, N. Y. App. filed Aug. 18, 1919. Registering lock system.

1,365,821. TROLLEY-WHEEL GUIDE; Charles F. Falline, Atlanta, Ga. App. filed Oct. 1, 1920. Prevent trolley wheel from jumping.

1,365,874. TROLLEY POLE; Edgar M. Wages, Los Angeles, Cal. App. filed Feb. 20, 1918. Will not leave wire.

1,365,875. ELECTROLYTIC CELL; Louis E. Ward, Midland, Mich. App. filed Dec. 13, 1918. Filter-press type.

1,365,880. ELECTRODE FOR SECONDARY OR STORAGE BATTERIES; James M. Allen, St. Louis, Mo. App. filed Dec. 1, 1919. In two sections.

1,365,885. PORTABLE ELECTRIC LIGHT; Bernard Benedict, New York, N. Y. App. filed April 30, 1919. Cannot be short-circuited from outside.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

TURNER, ME.—At a recent meeting of the Chamber of Commerce the proposition to extend the electric lighting system through the town was discussed with favor.

MIDDLEBURY, VT.—A power plant of the Hortonia Power Company, Brandon, which supplies energy to Mineville, N. Y., has been destroyed by fire. The loss has been estimated at from $35,000 to $125,000.

BOSTON, MASS.—The Metropolitan District Commission has voted to recommend the Legislature to replace gas and naphtha lamps with an electric light system on boulevards, parkways and state reservations. It has been suggested that the energy be supplied from the state reservoirs in Clinton and Sudbury, where electricity is generated.

BRIDGEPORT, CONN.—The Board of Fire Commissioners plans to expend $24,250 for the purchase of underground cables, alarm boxes and hydrants.

HARTFORD, CONN. — The Board of Water Commissioners, Hartford, is having plans prepared for the erection of a hydro-electric plant and the installation of equipment in connection with the new filtration plant in West Hartford. C. M. Saville, 1026 Main Street, is engineer.

SALISBURY, CONN. — The Salisbury Cutlery Handle Company has petitioned the Legislature for authority to generate and distribute electricity in this town. G. N. Clark is president of the company.

Middle Atlantic States

ANTWERP, N. Y.—The Antwerp Light & Power Company has applied to the Public Service Commission, Second District, for permission to operate an electric light plant.

BUFFALO, N. Y.—The Buffalo General Electric Company, Electric Building, contemplates extensions to its distributing lines in outlying districts of the city. It is estimated that from 140 to 145 miles of wire will be required for the proposed extensions.

GOWANDA, N. Y.—The Iroquois Utilities, Inc., 415 City Bank Building, Syracuse, has been authorized by the State Public Service Commission to issue $145,000 in bonds, of which $83,301 will be used in the construction of a new hydro-electric plant on the Cattaraugus Creek at Gowanda.

McKEEVER, N. Y.—The Iroquois Paper Company contemplates rebuilding the power dam across the Moose River at this point. The cost is estimated at $100,000.

MEDINA, N. Y.—The Western New York Utilities, Main Street, plans to make a survey preliminary to the construction of a third power dam, to be built at Oak Orchard-on-Ridge, 3 miles northeast of Medina.

OGDENSBURG, N. Y.—The City Council has granted permission to the St. Lawrence Transmission Company, Potsdam, to extend a high-tension transmission line through Ogdensburg.

WAPPINGERS FALLS, N. Y.—The Wappingers Electric Corporation and the Dutchess Bleachery have made joint application to the Public Service Commission for authority to transfer franchises and property of the Dutchess company to the Wappingers Corporation, the latter company also applying for permission to operate in Wappingers Falls and adjoining towns.

WATERTOWN, N. Y. — The Northern New York Utilities, Inc., 137 Arsenal Building, has petitioned the Public Service Commission for permission to extend its electric system to the towns of Alexandria and Theresa.

WATERTOWN, N. Y.—C. A. Bingham, city manager, has been directed to employ an engineer and to secure plans and specifications for the installation of equipment in connection with the erection of the proposed municipal hydro-electric power plant.

ATLANTIC CITY, N. J.—The City Council has plans under way for the erection of a two-story, 37-ft. x 50-ft. central station for city electrical systems, including the police and fire alarm at Tennessee and Railroad Avenues.

BLOOMFIELD, N. J.—Scott & Bowne, 80 Orange Street, do not contemplate the construction of a factory and power plant as reported on page 71, Jan. 1 issue.

GLASSBORO, N. J.—The Borough Council has plans under way for extensions to the present street-lighting system, including the installation of 250-cp. lamps and smaller lighting units.

NEWARK, N. J.—The Town Commission of Irvington plans to make improvements and extensions to the present lighting system for increased facilities.

TRENTON, N. J.—The Trenton Flint & Spar Company has plans under way for the construction of a power house at its plant on Marion Street.

CHAMBERSBURG, PA. — The borough officials, through J. H. Mowrey of the municipal electric light department, have plans under way and will receive bids about Feb. 15 for the construction of an electric power plant on Third Street to cost about $150,000. A. C. Woods, Stock Exchange Building, Philadelphia, is engineer.

ERIE, PA.—The Buffalo & Lake Erie Traction Company, Exchange Building, contemplates the installation of a trackless trolley system on Liberty Street Boulevard. Plans include the erection of a double trolley wire for overhead power supply.

FERNHILL, PA.—The water committee of West Chester Borough Council has plans under way for the installation of an electric pump and fixtures in the Fernhill water-works.

GREENVILLE, PA.—The Mercer County Light, Heat & Power Company contemplates the erection of a high-tension transmission line along Canal Street for the purpose of furnishing power to Stoneboro and Sandy Lake. F. A. Conner is general manager of the company.

PHILADELPHIA, PA. — The American Gas Improvement Company, Broad and Arch Streets, operating electric utilities in different parts of the country, has disposed of an issue of $7,500,000 in notes, the proceeds to be used for general operations, extensions and improvements.

CHARLESTON, W. VA.—The West Penn Electric Company, Pittsburgh, Pa., is awaiting the approval of the State Legislature at the March session in connection with the development of water power along the Cheat River. The cost of its projects is estimated at about $15,000,000.

SCHUYLER, VA.—The Virginia Alberent Corporation, W. W. Hepburn, vice-president and general manager, 1417 Pennsylvania Building, Philadelphia, Pa., is having plans prepared for a hydro-electric replacement plant to cost about $60,000. F. R. Weller, Hibbs Building, Washington, D. C., is engineer.

North Central States

CLEVELAND, OHIO. — The Board of Education, East Sixth Street and Rockwell Avenue, has plans under way for additional electric wiring and fixtures in forty-four schools to cost about $100,000. Bids will also be received until Feb. 21 for electric light reflectors and fixtures in the Warren Road School, to cost about $5,000. W. R. McCormack, above address, is architect.

IRONTON, OHIO.—The Tri-State Brick Company plans to erect an addition to its power plant.

FORT WAYNE, IND. — The Board of County Commissioners has had plans prepared and bids will be received about March 1 for the construction of a power house and county farm buildings to cost about $600,000. A. McCoy, Court House, is auditor.

LINTON, IND.—The city officials will soon receive bids for the construction of a power plant to cost about $100,000. Equipment will be installed, including turbine generator, condensers, motors, two 200-hp. water-tube boilers feed pumps, etc. Shrouds-Stoner Company, Tribune Building, Terre Haute, is engineer.

FREEBURG, ILL.—Plans are under way and bids will be received about April 1 for the construction of an electric light and power plant. Fuller & Beard, Chemical Building, St. Louis, Mo., are engineers.

LOCKPORT, ILL.—Bids will be received by J. Lambert, president of the penitentiary commission, Rookery Building, Chicago, until Feb. 24 for the construction of a power house, kitchen, dining hall and bakery at the new Illinois State Penitentiary. Zimmerman, Saxe & Zimmerman, 64 East Van Buren Street, Chicago, are architects.

SPRINGFIELD, ILL.—Plans are under way for the installation of a lighting system on Fourth Street to cost about $81,000. S. Wade, City Hall, is engineer.

ARNOLD, MINN.—The Arnold Welfare Club, of which J. Anderson is secretary, is interested in the establishment of an electric lighting system in Arnold. Energy will be supplied by the Duluth Edison Electric Company, Duluth.

BLUE EARTH, MINN.—The erection of a transmission line from the municipal electric light plant to supply light and power to Ceylon and Dunnell is contemplated.

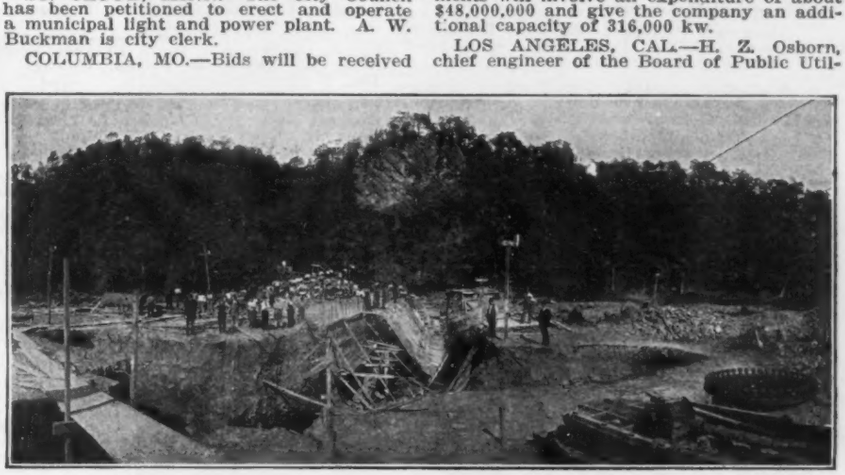
FERGUS FALLS, MINN. — The Otter Tail Power Company contemplates the erection of a transmission line to Rothsay. C. S. Kennedy is in charge.

OWATONNA, MINN.—A proposition to issue $475,000 bonds for the erection of a municipal light, heat, power and gas plant was submitted to the people at a recent election, but failed to carry.

ST. CLOUD, MINN.—The City Council has been petitioned to erect and operate a municipal light and power plant. A. W. Buckman is city clerk.

COLUMBIA, MO.—Bids will be received by J. S. Bicknell, city clerk, until Feb. 21 for the installation of a 1,000-kw. turbine-generator unit, switchboard and condenser in the light and water plant.

WARRENSBURG, MO.—The City officials contemplate the installation of an electric light plant. F. L. Wilcox, Syndicate Trust Building, St. Louis, is consulting engineer.



WILLIAMSBURG DAM, WHICH IS UNDER CONSTRUCTION FOR THE PENN CENTRAL POWER & TRANSMISSION COMPANY BY DAY & ZIMMERMAN, INC.

Southern States

DUNN, N. C.—The town officials contemplate rebuilding the power, light and water plant at a cost of about $100,000.

NEWTON, N. C.—Bonds to the amount of $14,000 have been issued for the installation of a light, power and water system.

ATLANTA, GA.—The Georgia Railway & Power Company, Gas & Electric Building, contemplates improvements to its system and the installation of additional equipment.

TAMPA, FLA. — The Tampa Electric Company plans to improve the street-lighting system by installing fifty 100-cp. lights.

MOUNTAIN VIEW, OKLA.—Plans are under way by V. V. Long & Company, Oklahoma City, for power-house equipment to be installed at the municipal pumping station.

OKMULGEE, OKLA.—The B. & A. Mining Company, McBrayer Building, will receive bids until March 1 for complete equipment, including electrically operated coal-mining machinery, hoisting engines, etc., for a new coal mine. The cost is estimated at $75,000.

PERSHING, OKLA.—The city officials contemplate the installation of an electric lighting system.

SAPULPA, OKLA. — The city commissioners have had an estimated prepared for the erection of an ornamental lighting system on six blocks of Dewey Avenue to cost about $16,775.

AMARILLO, TEX.—The City Commission plans to extend the lighting system and install 136 metal standards surmounted with groups of lights.

FORT WORTH, TEX.—The Peden Iron & Steel Company, Main and Daggett Streets, is having plans prepared for the erection of a steel-roller mill and fabricating plant to cost about $1,000,000. Electrically driven machinery will be installed. D. R. Luce is engineer.

RANGER, TEX. — The Wichita Falls, Ranger & Fort Worth Railroad Company contemplates the erection of a roundhouse and installation of a six-stall electrically driven turntable to cost about $100,000. J. H. Frazier is engineer.

Pacific and Mountain States

LOS ANGELES, CAL. — Plans of the Southern California Edison Company, 306 West Third Street, to cover six years of construction work, have been approved. The program includes the erection of a reservoir at Florence Lake, an 11-mile tunnel from Florence to Huntington Lakes, conduit from Huntington to Shaver Lakes, three hydro-electric generating stations and enlargement of power house No. 8. These developments will involve an expenditure of about $48,000,000 and give the company an additional capacity of 316,000 kw.

LOS ANGELES, CAL.—H. Z. Osborn, chief engineer of the Board of Public Utilities, has submitted plan to the City Council, which provides for the construction of an electric subway system. The cost is estimated at $600,000.

RIVERSIDE, CAL.—The Southern Sierras Power Company plans to extend $2,183,329 for new construction and improvements, including hydro-electric development, rebuilding distribution lines, increasing transformer capacity, extensions to substations and additional telephone circuit.

WILMINGTON, CAL.—The Chamber of Commerce is in favor of holding a special election for the purpose of submitting an issue of bonds for the construction of an electric railway in the city. It is also intended to campaign for improved street lighting, including an extension to the ornamental system on Canal Avenue.

OGDEN, UTAH.—An election will be held the last week in February for the purpose of submitting to the voters a proposition to issue $500,000 in bonds for the erection of a municipal light plant.

KELLOGG, IDAHO.—The Bunker Hill & Sullivan Mining & Concentrating Company contemplates the erection of an electrolytic zinc refinery to cost about $1,000,000.

OVID, COL.—The State Public Utilities Commission has granted permission to the Ovid Light & Power Company to connect with the transmission line between Julesburg and Sedgwick by installing a step-down transformer for the purpose of supplyng energy for light and power in Ovid.

Canada

ST. THOMAS, ONT.—The City Council contemplates the installation of a rotary converter in the municipal electric station. Councillor Walker is chairman of committee No. 5.

ST. THOMAS, ONT. — Bonds to the amount of $233,000 have been voted for the construction of a dam across Kettle Creek. Electric pumps will be required. W. C. Miller is city engineer and R. S. and W. S. Lea, New Birks Building, Montreal, Que., are consulting engineers.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Atlantic City, N. J., April 21-23.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Lakeland, Fla., Feb. 7 and 8.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill. Annual convention, Chicago, Ill., Dec. 9.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, Public Service Commission of the State of New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION N. E. L. A. Secretary, Miss O. A. Bursiel 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION Secretary-treasurer, Charles E. Twogood Albuquerque N. M. Annual meeting, Albuquerque, N. M., Feb. 16-18.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis, Minn.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal. Annual meeting, Del Monte, Cal., May 25, 26 and 27.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 5th Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis. Annual meeting, Milwaukee, Wis., March 23-24.